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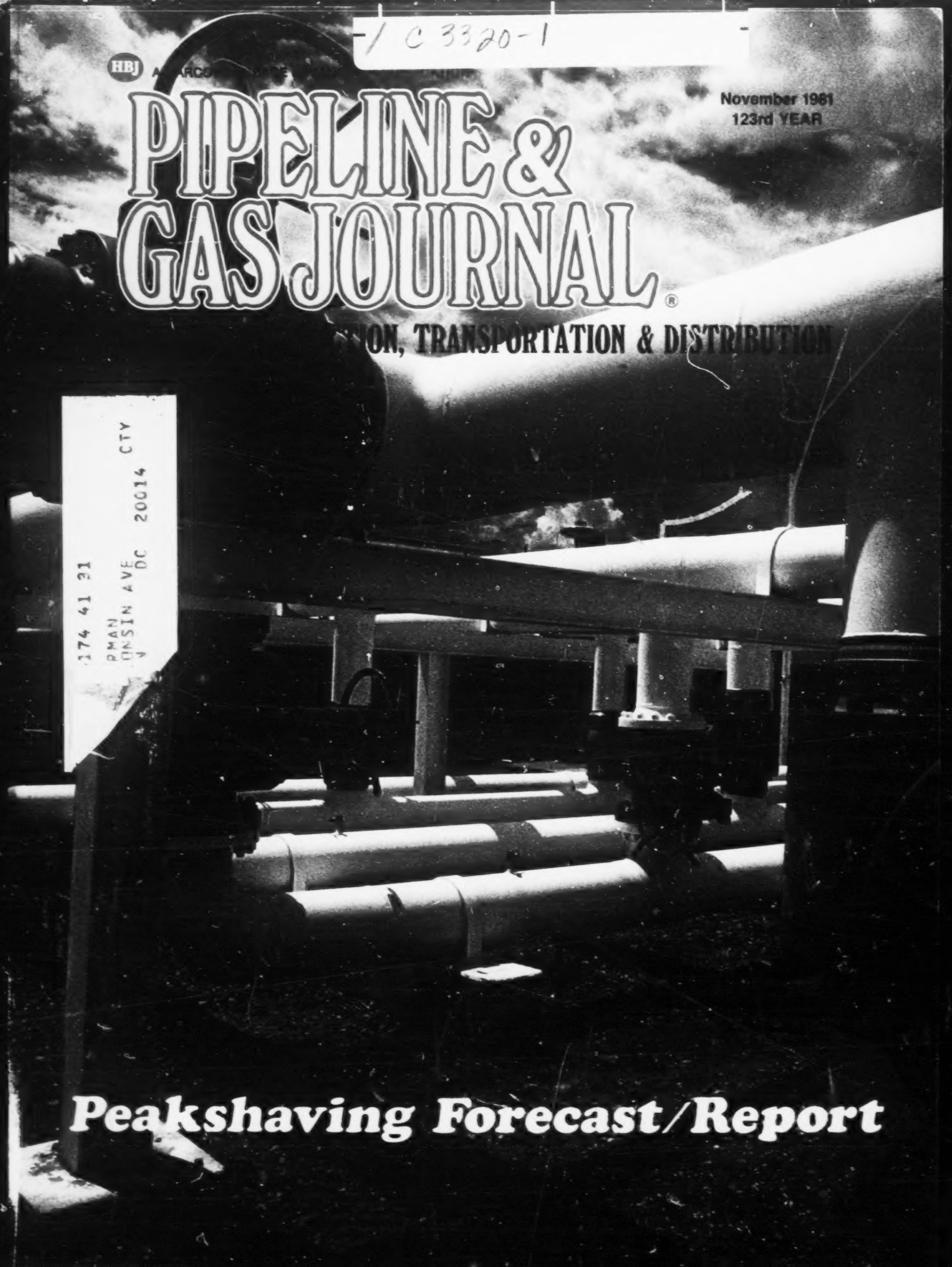

November 1981
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Peakshaving Forecast/Report

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COVER

Storage facility piping characterizes the peakshaving aspects of the gas industry, which must rely heavily on underground gas storage, propane-air plants, LNG peakshaving facilities, and related operations to meet wintertime's high demands.

—Photograph courtesy Montana Dakota Utilities Company

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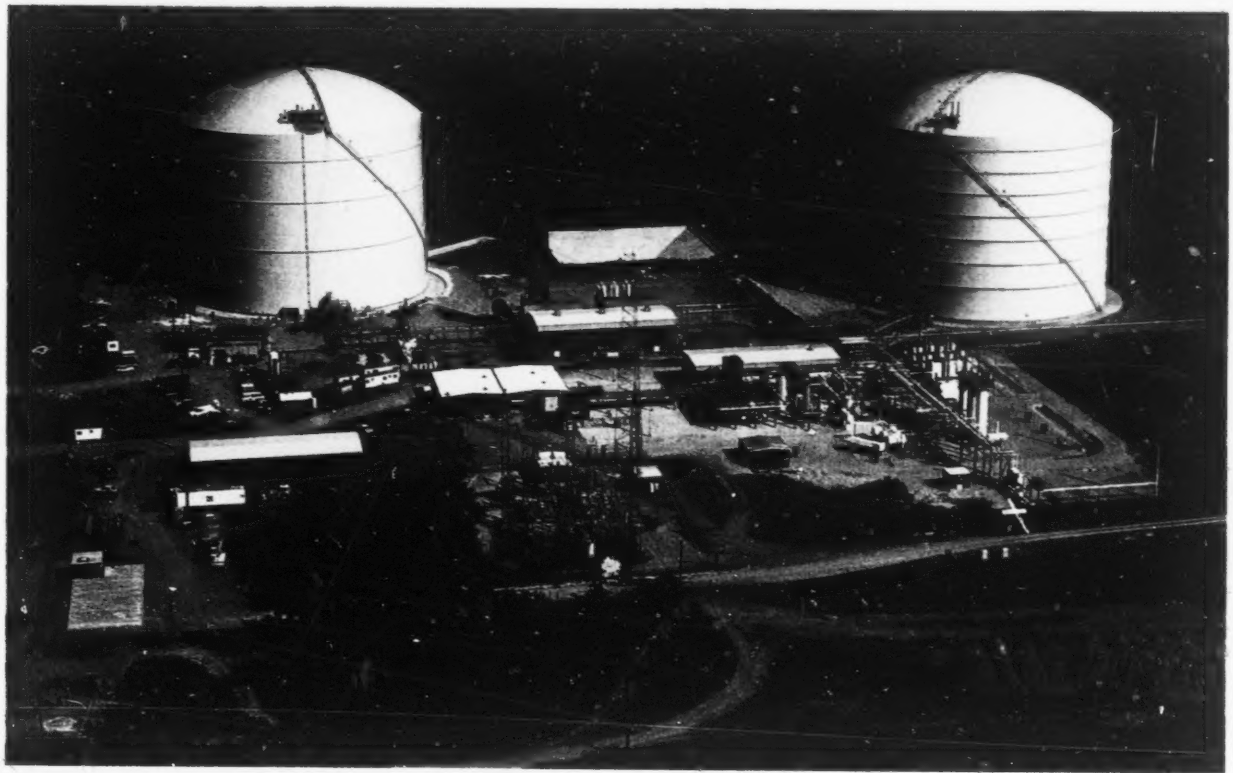


Photo Courtesy NIPSCO.

Total capacity of Northern Indiana Public Service Co.'s LNG peakshaving plant at La Porte, Indiana, has been increased to an equivalent 4 billion cu ft with addition of a second tank, shown here at left. New tank has capacity of 2 billion cu ft equivalent (580,000 bbl) and was built by Chicago Bridge & Iron Co. Regasification capacity was also doubled and plant sendout is now a total of 400 million cu ft per day. Lotepro was contractor for the plant.

'81-'82 Peakshaving Capacity Is Gas Industry's Best Ever

by Dean Hale, *Editor*

America's natural gas industry continues to build its capacity to provide peakshaving gas supplies to meet expanded heating season needs of its more than 48.5 million gas customers during the 1981-82 winter.

With some 39 million gas customers heating their homes with natural gas, it is essential to have adequate supplies from both contract and supplemental sources to insure continued service despite blizzards, blue northers, and extended cold spells.

PIPELINE & GAS JOURNAL's latest annual peakshaving survey indicates that the gas industry will have a capacity of 72.87 billion cu ft maximum delivery from all of its various peakshaving gas sources in a single 24-hr period. Adding to that an estimated 66.2 billion cu ft of regularly scheduled deliveries produces a projected maximum delivery in one day that could reach 139.1 billion cu ft – not likely to be needed at one time as the entire nation seldom experiences a major, nation-wide cold spell in all of the 48 contiguous states at the same time.

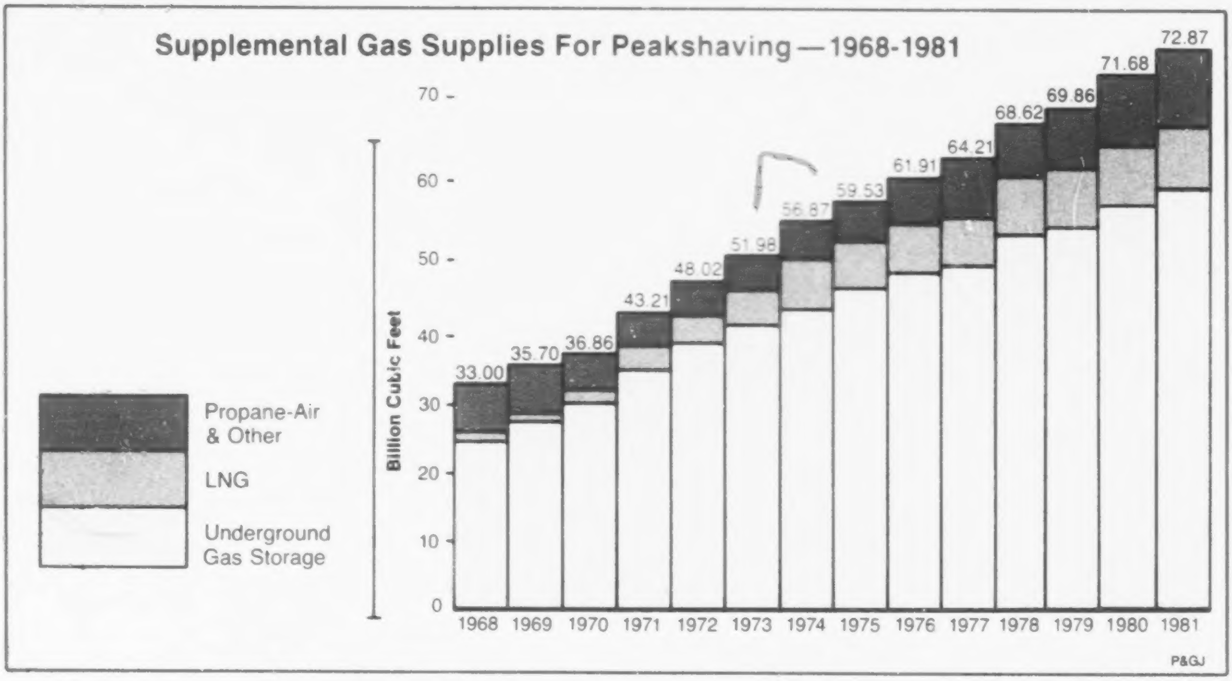
For the 1981-82 winter, the industry's top peak-day sendout total is expected to range from 80 to 88 billion cu ft in a single 24-hr period.

For some areas of the nation, particularly in the north central and northeastern states, supplemental gas supplies will be required to provide a substantial part of the gas demand at any one time during the winter season.

For the 1981-1982 winter season, peakshaving supplies will include:

58.40 Bcf from underground gas storage
5.21 Bcf from propane-air plants
8.99 Bcf from LNG peakshaving and satellite plants
0.27 Bcf from other sources

The increase in deliverability – 1.239 Bcf – from underground gas storage facilities continues a trend of recent years in which gas storage is assuming an increasingly important role in gas supply operations. Deliverability from LNG peakshaving plants continues to be static – no significant new LNG projects were added in 1981 – and operators of existing plants continue to "fine tune" them to obtain slight increases in deliverability. Propane-air plant additions tapered off in 1981 as utilities attempted to match customer demands with system supplies. The "other" sources include sendout from SNG plants operated for peakshaving purposes (making high Btu gas from naphtha and other hydrocarbons). Cost of the petroleum feedstocks skyrocketed in 1980 and the plants are operated only if absolutely necessary. Other sources also



Supplemental Gas Supplies For Peakshaving—1968-1981

include line pack, buried bottle-type storage, gas holders (few remain in the U.S.), and enrichment of gas stream by direct injection of propane or ethane to boost Btu content.

Underground Gas Storage

The search for underground gas storage continues as companies seek tight caverns, abandoned oil and gas fields, and aquifers for containment of gas supplies nearer to the markets – or at least intermediate between production areas and markets.

Developing new storage facilities – drilling and completing injection and withdrawal wells, observation wells, installing field lines, and installing compressor horsepower and related measurement, filtering, dehydrating, and odorization equipment and control systems and communications systems – required an investment of $314,800,000 during 1981 (compared to $352,240,000 in 1980), and for 1982, an estimated $286 million will be spent for new facilities and field development. This projection does not include projects not yet announced.

As of Nov. 1, 1981, there were 404 gas storage fields being operated or developed by 92 companies, including 392 fields that are considered active, another 12 under development or planned.

Maximum deliverability of the 392 active fields is estimated at 58.403 Bcf per day in a 24-hr period, according to PIPELINE & GAS JOURNAL's peakshaving survey data.

At the 404 operating and under-development gas storage fields, current data indicates there are 18,065 wells (a net increase of 170 over 1980); 6820 miles of field lines (up 79 miles over 1980's total), and a net gain of three compressor stations with a net increase of 60,596 hp for the year.

Current gas storage developments include:

Western Slope Gas Co. has completed its Roundup gas storage field in Morgan County, Colo., which is expected to provide up to 50 MMcf of gas per day when full operation is assumed. Field has a working capacity of 4,200 MMcf and total capacity of 11,400 MMcf.

Southeast Michigan Gas Co. has completed its Collin gas storage field in St. Clair County, with a working capacity of 1,500 MMcf; total capacity of 2,400 MMcf; and an estimated design deliverability of 25 MMcf per day.

El Paso Natural Gas Co. plans to be able to make withdrawals during the 1982-1983 winter season from its Washington Ranch field in Eddy County, N. M. The field has a design deliverability of 400 MMcf per day.

Southern California Gas Co., Pacific Lighting Service Co., and Pacific Gas & Electric Co. are in the second year of jointly developing the Ten Section Field, near Bakersfield, as a giant gas storage facility. The depleted oil field, with facilities costing $195.5 million, will have a 50 Bcf working capacity. SoCalGas and PG&E will each own 50%. The field is also expected to produce another 5.6 million bbl of oil as a result of the gas injection and withdrawal. Work on the first stage of the project is scheduled for completion in April 1982. Final completion is scheduled for 1984.

Pataya Storage Co., Las Vegas, Nev., is awaiting FERC approval to use a salt cavern in northern Mohave County of Arizona for gas storage. The salt body, 12 miles long by 5 miles wide by 2 miles thick, is to be excavated by solution mining technique. Cost of the project is estimated at nearly $43 million. Storage area is some 30 miles from El Paso Natural Gas Co.'s main transmission system and EPNG would utilize the storage cavern.

Arkansas Louisiana Gas Co. has completed construction of its Chiles Dome Field in Oklahoma and has been injecting gas in contemplation of withdrawals from the field for the 1981-1982 season.

Valero Gas Storage Co. plans to sell and lease back its gas storage facilities in Wharton County, Tex. Valero will receive some $55 million from the sale of four caverns to ML Caverns Inc. and GATX Storage Services Inc. Two of the caverns, costing $36.2 million, are covered in the initial transaction. Two more caverns, currently being mined, will be completed in 1982. Injection of gas into the first two caverns was completed in October and Valero expects to make some withdrawals in the 1981-1982 season.

Minnesota Gas Co. is proceeding on schedule in developing a second storage field in southern Minnesota, near Wells, about midway between the state's east-west boundaries. Work has been underway at the site since 1976. A 90-day water pumping test, completed in 1980, indicated positive reservoir data. Storage depths are expected to be about 1200 ft. Capacity estimates vary, but potential could be as high as 50 Bcf.

Mississippi River Transmission Corp. plans to spend $2

U.S. Underground Gas Storage Operations — Operating Companies — 1981 Data

Company		No. of Fields	No. of Wells	Miles Storage Lines	Storage Compressor Stations No.	Storage Compressor Stations HP
ANR Storage Co.		4	50	25.10	3	33,750
Arkansas Louisiana Gas. Co.		5	73	39.00	5	42,200
Arkansas Oklahoma Gas Corp.		1	12	3.00	1	370
Arkansas Western Gas Co.		4	12	3.72	4	1,175
Battle Creek Gas Co.		3	3	2.00	2	1,050
			— (1 under development) —			
Bear Creek Storage Co.		1	52	25.5	1	28,000
Brady, Tex., Municipal Gas Corp.		1	2	2.00	1	420
Cabot Corp.		2	13	14.60	2	2,395
Central Illinois Light Co.		2	86	21.27	2	4,265
Central Illinois Public Service		3	78	9.80	3	3,220
			— (1 under development) —			
Cities Service Gas Co.		10	589	164.00	6	29,800
Citizens Gas & Coke Utility		8	182	319.00	2	3,695
Colorado Interstate Gas Co.		4	122	230.00	3	9,700
Columbia Gas Transmission Corp.		49	3,685	1,208.10	27	108,625
Columbia Gas of Pennsylvania		1	8	3.43	1	900
Consolidated Gas Supply	Owned	9	1,054	458.00	9	119,300
	Joint	4	295	117.00	8	60,390
		13	1,349	575.00	17	179,690
Consumers Power Co.		11	477	128.66	4	78,810
Delhi Gas Pipeline Corp.		1	— (under development) —			
East Ohio Gas Co.		4	757	253.50	3	20,220
El Paso Natural Gas Co.		2	35	39.00	1	4,400
			— (1 under development) —			
Equitable Gas Co.		15	280	127.95	9	15,330
Felmont Oil Corp.		1	10	6.00	1	1,050
Egyptian Gas Storage Co.		2	3	—	—	—
Gas Utilities (Ill.)		1	4	3.10	—	—
Hampshire Gas Co.		1	13	17.00	1	1,640
Honeoye Storage Corp.		1	34	15.80	1	2,200
Hoosier Gas Corp.		3	24	8.30	0	—
Houston Pipe Line Co.		1	58	12.00	3	13,410
Illinois Power Co.		8	237	34.75	8	12,100
Indiana Gas Co.		7	290	104.78	4	2,845
Kane Gas Light & Heat Co.		1	21	10.00	1	60
Kansas Nebraska Natural Gas		4	34	23.40	3	5,530
Laclede Gas Co.		1	50	32.08	1	9,020
Lawrenceburg Gas Co.		1	1	—	—	—
Lone Star Gas Co.		12	112	78.58	11	24,835
Louisville Gas & Electric Co.		9	837	126.16	3	19,055
Michigan Consolidated Gas Co.		5	514	90.00	4	71,000
Michigan Gas Storage		3	554	166.10	1	30,900
Michigan Gas Utilities Co.		1	4	3.00	1	800
Michigan Wisconsin Pipe Line Co.		15	1,254	316.00	10	110,700
			— (1 under development) —			
Midwestern Gas Transmission Co.		3	55	11.70	2	1,593
Minnesota Gas Co.		2	40	15.00	1	2,200
			— (1 under development) —			
Mississippi River Transmission Corp.		3	66	72.06	3	22,050
Mississippi Valley Gas Co.		1	3	1.00	1	584
Montana-Dakota Utilities Co.		3	87	103.00	3	22,422
Montana Power Co.		4	39	38.00	3	5,960
Mountain Fuel Resources Inc.		1	26	15.50	1	28,400
Mountain Fuel Supply Co.		3	26	10.0	3	6,000
Mustang Fuel Corp.		1	1	4.00	—	—
National Fuel Gas Supply Corp.	owned	30	951	486.80	14	237
	joint	4	329	63.10	(4)	(39,900)
	Total	34	1,280	549.90	14	237
			— (3 under development) —			
National Gas & Oil Corp.		3	31	8.00	3	1,950
National Zinc Co.		1	7	—	1	119
National Gas Pipeline Co. of America		13	850	305.00	8	119,040
North Penn Gas Co.	owned	2	18	12.66	1	4,995
	(joint	1)				
Northern Gas Co.		4	8	13.00	4	1,900
Northern Illinois Gas Co.		7	505	264.03	6	113,990
Northern Indiana Public Service		2	135	29.00	2	7,320
Northern Natural Gas Co.		3	306	185.80	2	21,160
Oklahoma Natural Gas Co.		4	60	22.00	2	11,200
Pacific Gas & Electric Co.		3	95	22.47	3	14,990
Panhandle Eastern Pipe Line Co.		5	241	114.00	5	19,680
Peoples Gas Light & Coke Co., The		1	137	189.00	1	14,900
Peoples Natural Gas Co.		11	86	37.00	12	10,720
T. W. Phillips Gas & Oil Co.		7	74	—	7	1,995
Phillips Petroleum Co.		3	6	22.00	2	620
Pioneer Natural Gas Co.		2	1	1.00	1	880
			— (1 under development) —			
Public Service Co. of Colorado		1	13	8.27	1	17,000
South Louisiana Production Co.		1	3	10.00	1	30
Southeastern Michigan Gas Co.		3	8	2.00	3	3,920
Southern Indiana Gas & Electric Co.		2	83	17.30	2	1,500
Southern Natural Gas Co.		1	72	48.22	1	21,750
Southern California Gas Co.		7	320	110.50	6	104,090
			— (1 under development) —			
Southwest Gas Corp.		1	— (under development) —			
Southern Union Co. (Gas Co. of New Mex.)		1	11	12.00	1	3.00
Southwest Gas Storage Co.		1	49	18.00	1	6,000
Southwestern Gas Pipeline, Inc.		2	11	3.45	1	440
Tennessee Gas Pipeline Co.	(joint)	(5)	(406)	2.00	2	19,600
Texas Eastern Transmission Corp.	owned	1	75	28.50	1	11,000
Texas Gas Transmission Corp.		10	457	217.26	11	19,765
Transcontinental Gas Pipe Line Corp.	owned	3	57	22.45	3	46,100
	(joint	2	181	79.00	2	34,300)
Trunkline Gas Co.		1	83	27.00	1	15,400
Union Gas System, Inc.		5	115	25.00	2	660
Union Light, Heat & Power Co.		1	25	28.00	—	—
United Gas Pipe Line Co.	owned	1	19	6.10	1	2,550
	joint	1	73	21.70	1	34,000
		2	92	27.80	2	36,550
Valero Gas Storage Co.		1	2	(under devel.)		8,000
Victor Gas Co.		1	6	12.00	2	300
Washington Natural Gas Washington Water Power Co. Northwest Pipeline Corp.	joint	1	77	9.90	1	12,500
Western Kentucky Gas Co.		6	58	19.30	4	1,555
Western Slope Gas Co.		3	37	27.34	2	3,368

million on a three-year further development of its East and West Unionville Storage Fields in Lincoln Parish, La.

Propane-Air Plants

Activity in the addition of propane-air plant capacity slowed somewhat in 1981 as gas distribution utilities, looking at weakened housing demand and lowered gas demand, sought to match existing gas supplies with customer requirements. Even so, there was a slight gain – propane-air plants in the U.S. registered a gain of two (to a total of 503) and are operated by 242 gas utilities in 41 states. Deliverability of the facilities increased marginally to 5.21 Bcf per day total. An estimated 10 million gal. of additional propane storage was added at both new and existing propane-air plants during 1981.

LNG Peakshaving Developments

In the U.S., activities relating to the construction of new LNG peakshaving facilities show very little change from one year ago.

Northern Indiana Public Service Co.'s second LNG plant has been completed and is now on-stream, liquefying gas to meet this winter's heating season demands.

Southwest Gas Corp.'s H. G. Laub peakshaving plant construction at Dayton, Nev., continues to be on schedule. CBI's latest project, barring delays by regulatory agencies, calls for a May 1982 mechanical completion of the plant. As noted, CBI has a turnkey contract for the facility.

Energy Terminal Services continues to process its application to convert the Staten Island Terminal site to a peakshaving facility. FERC issued its draft supplement to the final environmental impact statement covering the proposed change from an import terminal to a peakshaving facility. In summary, the draft supplement included evaluations of safety related aspects of the site and alternative sites for the facility.

From its analyses of vapor and radiation hazards for major LNG spills at the facility, FERC concluded that the hazard would normally be confined to the plant site. Under some conditions an LNG storage tank fire could cause high levels of radiation at nearby property lines, but the levels would still be less than the maximum permitted by MTB's regulations for new LNG facilities. The analysis of flammable vapor cloud hazards was hindered by lack of information about the final dimensions of the containment systems.

Nevertheless, preliminary results indicate that if an LNG transfer line failed at either the vaporizers or storage tank dikes, flammable vapors could drift offsite under adverse meteorological conditions. The proper application of subdikes, insulated containment surfaces, or vapor barriers will be required to eliminate this hazard, according to the Draft Supplement.

FERC also concluded that none of the alternative sites examined in New York City or New Jersey are significantly superior environmentally to the existing ETS site at Rossville. Furthermore, the time required to design, construct, and obtain the necessary permits for an entirely new facility would delay the project far behind the 1983 start-up of the present proposal. In addition, the staff noted that NYCFD regulations restricting LNG storage tank capacity and construction pose additional obstacles to siting a large LNG storage facility in New York City and limit the economic viability of such a project.

Although it concluded that the existing and planned facilities could be constructed and operated successfully, FERC did recommend that, as a result of its analysis, 25 specific items be included as conditions to a certificate of public convenience and necessity if the project is approved.

In early July, Judge Bramwell of the U.S. District Court for the Eastern District of New York upheld the constitutionality of the New York Liquefied Natural and Petroleum Gas Act.

ETS had in essence contended that the Natural Gas Act provisions as implemented by FERC covered, and hence preempted, the state requirements for need for the gas and attendant facilities and safety aspects as the lead federal agency under the National Environmental Policy Act. It also contended that provisions of the Natural Gas Pipeline Safety Act, as implemented by MTB, covered safety related issues of siting, design, construction, and operation. Only the land use of siting was not covered by Federal regulation and this had accounted for zoning at the time the facility was constructed.

In rejecting ETS' position of preemption, the judge concluded that the New York Act only involved siting and argued, with regard to the Gas Act, "that before a state statute can be preempted, Congress must implicitly or explicitly evidence an intent to prohibit state regulation." The court found no such intent. With regard to the NGPSA, the court concluded that the Act "does not sufficiently address the question of siting so as to preempt the New York Act." The judge, in asserting that the New York Act only involves siting and that the federal acts do not preempt state activities in this area, would appear to be on rather uncertain ground.

Subsequent to the ruling, ETS filed a petition for review in the U.S. Court of Appeals for the 2nd Circuit.

Yerevan, Armenia may be the site for construction of the Soviet Union's second LNG peakshaving plant. At the Sept. 23-26, 1980, meeting of the International Institute for Applied Systems Analysis, Dr. Y. Oseradko, leading engineer, All-Union Design Institute for Gas Industry, described an LNG peakshaving facility at Yerevan in Armenia. Construction of the facility reportedly has not begun. When completed, this would be the second peakshaving facility in the Soviet Union. The first, completed outside Moscow in 1948 and built under the Lend-Lease program, is reportedly still in operation.

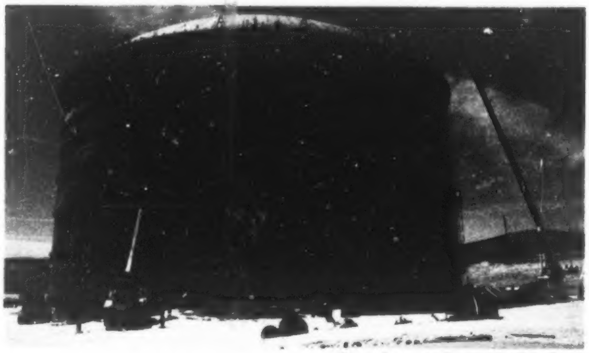


Photo Courtesy Southwest Gas Corp.

Construction is underway at Southwest Gas Corp.'s LNG peakshaving facility at Lovelock, Nev. Storage tank, shown here, will have capacity of 290,000 bbl, equivalent to 1 billion cu ft of gas. Sendout capacity will be 70 million cu ft per day. Completion is scheduled for 1982.

The facility at Yerevan is to have a liquefaction capacity of 20 tons/hr (25 million cu ft per day). Storage will be in three 60,000 m^3 (378,000 bbl) tanks. Vaporization capacity is to be 10 million m^3 (gas) per day (370 million cu ft per day). Liquefaction is designed to fill storage in 160 days, with the duration of operation being cited as 180 calendar days. Regasification capacity is designed to vaporize the stored LNG in approximately 11 days of operation. According to the description of the plant, it is designed to supply revaporized LNG to the gas pipeline from Astra on the Caspian Sea during 10 to 20 of the coldest days in winter.

Gas feed from the main gas pipeline feeding Yerevan is to be compressed in compressors from a pressure of 1.96 mPa (288 psi) to a pressure of 4.9 mPa (720 psi). After compression, CO_2 is removed and the gas dehydrated in the pretreatment step. A propane-staged mixed refrigerant cycle is to be used. The mixed refrigerant will contain nitrogen, methane, ethane, and propane. Storage will be at near atmospheric pressure. The vaporizers will be of the integral type, but it is not possible to tell from the description as to whether they are direct fired or submerged combustion. Sendout gas pressure is 5.39 mPa (790 psi).

No dates were given for completion and start-up of the peakshaving facility at Yerevan.

LNG legislation and regulation have always been areas of concern for the LNG industry. In 1980, a final rule establishing new safety standards governing operations, maintenance, fire protection, personnel qualifications and training, and security of LNG facilities was published in the Oct. 23 *Federal Register*.

The final rules as developed by the Materials Transportation Bureau had been modified from those that had been initially proposed. The modifications made were felt by many industry commentors to have made the regulations more acceptable to them.

Of a positive benefit to the industry was the signing into law on Dec. 12, 1980 of the *Methane Transportation, Research, Development, and Demonstration Act*.

The act establishes an RD&D Program with DOE to support accelerated research into the development of methane-fueled vehicles, related technologies, and domestic methane resources. The bill authorizes \$3 million for fiscal year 1982, and \$5 million for each of fiscal years 1983 and 1984. Funding was to begin in October 1981.

The program is intended to demonstrate the feasibility of methane-powered vehicles for fleet use and to promote their use, espically in areas where air-quality conditions are poor. At least half of the money will be used for loans to private industry; the rest will be in the form of grants to state and local governments. The funding may not be used for actual vehicle conversion but is intended for support facilities such as methane pumps, compression and liquefaction equipment, and small-scale storage. The legislation envisages the implementation of at least 50 demonstration projects, each with at least 50 vehicles.

LNG to the rescue is a phrase that is not often heard. But it was this past winter in New England when a delivery capacity problem for pipeline gas deliveries occurred. The situation came to a head beginning Jan. 10 when three utility companies in Massachusetts declared that emergency conditions existed and asked customers to conserve gas supplies. Lowell Gas Co., Cape Cod Gas Co., and Boston Gas Co. all cited the limited availability of natural gas as the reason for the emergency.

Massachusetts Governor Edward J. King declared a state energy emergency on Jan. 13. He ordered all nonresidential buildings heated by natural gas to lower their thermostats to 55 F, but exempted such facilities as hospitals and nursing homes. Residential customers were encouraged to lower their thermostats to 63 F. Massachusetts officials also asked utilities on Sunday, Jan. 11, to pool gas resources.

City officials in Lowell declared a state of emergency and closed all schools through mid-week. They also asked businesses that could not switch to other fuels to close. Many schools were also closed on Cape Cod.

Of the three utilities, Boston Gas is the largest distributor, serving 500,000 customers in 24 cities and towns. Lowell Gas serves 37,700 residential and 3,900 commercial customers. Cape Cod services 27,400 residential and 2,900 commercial customers. Lowell Gas and Boston Gas have LNG peakshaving facilities; Boston Gas and Cape Cod Gas have satellite facilities.

The shortage of gas was caused by a delivery capacity problem. According to Boston Gas, three circumstances combined to create the crisis:

1) the coldest weather New England has had in more than 100 years,

2) delay of shipments of LNG gas from Algeria caused by a severe storm along the Mediterranean coast, and

3) a sharp "uncharacteristic" increase in gas usage by Boston Gas customers.

In addition, the three situations all developed within an extremely short period of time. One Boston Gas official indicated that if each of the three events had occurred individually, they could have been handled by the company.

Two interstate pipelines, Tennessee Gas Transmission and Texas Gas Transmission, indicated that their lines were flowing at capacity but could not flow enough gas to meet demand. LNG, the only available source of supply, was used to the maximum extent possible. However, the volumes in storage were not sufficient, and they were not designed for the level of the demand and its two-week duration. Arrival of LNG from Algeria was delayed, as noted. It should also be noted that the quantities of LNG delivered from Algeria to Distrigas of Massachusetts' terminal at Everett during the winter period of 1980-81 were at or above contract quantities. They have continued at this level to date.

To obtain a supply of LNG as rapidly as possible, Boston Gas Company contracted with Southern Energy Co. to purchase or exchange approximately 1.3 Bcf (60,000 m^3 liq.) of gas as LNG in storage at Southern Energy's terminal at Elba Island. As no American flag vessel was available to transport the LNG, a waiver of the Jones Act was necessary to transport the LNG aboard the *Larbi Ben M'Hidi*, an Algerian flag LNG carrier that was in Boston undergoing some minor shipyard repairs while awaiting the reopening of the port of Bethioua, Algeria. The *Larbi Ben M'Hidi* had delivered its cargo of LNG to DOMAC on Dec. 27-28.

On Jan. 14, the applicants – Boston Gas Co., Southern Energy Co., and Southern Natural Gas Co. – had sought a waiver and clarification of the emergency gas-sale regulations to enable Southern Energy and Boston Gas to go forward with an agreement whereby Southern Energy would provide emergency volumes of LNG to Boston Gas in exchange for thermally equivalent volumes of LNG to be redelivered by Boston Gas at a later date.

On Jan. 16, FERC commissioners issued their findings and granted the applicant's request for clarification and waiver, as required, by the Commission's Emergency Regulations. The waiver of the Jones Act provisions was obtained by Senator Kennedy's office upon the request of Governor King and the utility companies from the Treasury Department.

The *Larbi Ben M'Hidi* left Boston on Jan. 15 and arrived at Elba Island at 7 p.m. on Jan. 18. The 60,000 m^3 of LNG was loaded aboard the vessel and it departed Elba Island at 12:12 a.m. on January 20. The *Larbi Ben M'Hidi* unloaded its LNG at DOMAC's Everett terminal on Jan. 22 and 23. The unloading received very favorable extensive TV and press coverage.

Meanwhile a second Algerian LNG tanker, the *Mostefa Ben Boulaid* loaded a light cargo of LNG on Jan. 23 at Bethioua, Algeria. The 93,000 m^3 representing the heel in the storage tanks at the LNG plant arrived at DOMAC's terminal on Feb. 7.

With moderating weather, Governor King was able to lift the state executive order restricting gas usage on Jan. 25 citing diligent conservation efforts and increased supplied including LNG.

During the period from Jan. 10-25, LNG in peakshaving storage in New England, LNG delivered by tanker from Algeria, and LNG trucked from other areas including the southeastern states was a major factor in alleviating a serious supply situation.

Worldwide LNG Projects Hit By Price, Contracts

The past year of base-load LNG projects has been underscored by two factors: *price and sanctity of contract*.

The price of LNG has escalated sharply as has the price of crude oil. As a result of this escalation and a general turndown of the world's economics, a surplus of petroleum has developed. Consequently what might be termed a "firming" of energy prices has occurred. Because many LNG base-load supply contracts are tied to alternative fuels or to the price of a market basket of crudes, LNG prices have moved upward in tandem with other energy prices.

The problem from the exporting country's view has been and continues to center about the issues of the base price value from which the escalation is calculated, whether the change in price of his crude oil is fully reflected in the LNG price, and whether his price reflects an f.o.b. price or a c.i.f. price for the product.

It is this latter question of who pays for the higher cost of transport and terminalling LNG that has led to the problems relating to sanctity of contract. The importing country views natural gas as being a product that does not and cannot compete directly with imported oil. In a period of shrinking economic activity he cannot afford to price his product out of reach of his customers.

The impact of LNG prices over the past 18 months is exemplified by Japan. In 1980 Japan accounted for approximately 73.8% of the world trade in LNG. The percentage represented by the Japanese trade was indeed up sharply over 1979 when Japan accounted for only 56% of the world's LNG trade. Japan's trade volume, however, did increase between 1979 and 1980.

Regarding price, Japan paid an average price in 1980 for her imported LNG that was 79.5% higher than the price paid to her suppliers in 1979. During the first half of 1981, the average price paid only escalated by 13.1%. On a Btu basis the prices paid in June for LNG from the four suppliers were Indonesia - $5.16/MMBtu, Brunei - $6.38/MMBtu, Abu Dhabi - $6.60/MMBtu, and Alaska - $6.22/MMBtu.

Indonesia was the lowest priced source of supply, reflecting in part the influence of the U.S. dollar's strength compared to a market basket of currencies on the pricing formula. Abu Dhabi was the highest priced supply reflecting the fact that its supply contract ties the price of LNG directly to the price of its Murban 39° crude oil.

On the other side of the world, Algeria successfully renegotiated its LNG sales price with one customer, Distrigaz S.A. of Belgium. On April 8 the announcement was made of a new pricing provision covering deliveries over a 20-year period beginning in October 1982. The provisions announced by Algeria's Oil Minister Belkacem Nabi included an f.o.b. base price of $4.80/MMBtu effective on Jan. 1, 1981. This price will escalate 100% with the price of a basket of crude oils based 50% on those imported by Belgium and 50% on those from OPEC countries exporting LNG. As of Jan. 1, 1981, a year later, the calculated price had escalated by 17%, to an estimated $5.60 MMBtu.

In announcing the agreement, Minister Nabi described it as a starting point and basis for future gas sales contracts with Algerian customers and the first contract to establish a formula that ties the price of gas exports to those of crude oil. As of the date of this writing, Algeria has yet to conclude a revised pricing provision for any of its sales contracts. Negotiations are proceeding with varying intensities with each of them.

Concern over sanctity of contract was brought to a head when the last cargos of Algerian LNG arrived at U.S. terminals under the El Paso project. The dates were April 10, 1980, for the Cove Point, Md., terminal and April 9, 1980, for the Elba Island terminal.

The cessation of deliveries resulted from the rejection of amended contract terms by the Algerian government. Algeria considered that the contract with the El Paso Co. was, therefore, no longer in force. El Paso considered that the *Force Majeure* provisions of the contract had been invoked.

Negotiations were begun to arrive at a new provision that could be acceptable to both parties (El Paso Co. and Sonatrach) and both countries (Algeria and the United States). Because approval for any amended contract terms would need to be approved by the U.S. government, the negotiations were carried out on a state-to-state basis. Leslie Goldman, assistant secretary of energy for international affairs, headed the U.S. team.

Negotiations continued with the location shifting back and forth between Algeria and Washington. Progress was reported to be substantial or minimal with each meeting but no agreements were concluded. With President Carter losing the election, time for conclusion of an agreement under his term of office grew short. The sixth and last negotiation under his administration took place in Washington Jan. 12-16.

The f.o.b. price was one of the areas of remaining disagreement. The U.S. negotiators were reportedly still seeking parity with the Canadian price of $4.94/MMBtu, less a transportation and handling charge of approximately $1.25/MMBtu, for an f.o.b. price of about $3.70/MMBtu. The Algerians are believed to have been seeking a price of about $4.00/MMBtu f.o.b. Escalation based on an energy equivalence with crude oil escalation as the Algerians were seeking or on other U.S. gas imports as DOE was seeking also remained an unresolved issue.

With the change of administrations, the Algerians had apparently perceived that negotiations would not resume until after the Reagan administration appointed replacements for the negotiators, and they had been brought up-to-date on the previous discussions and outstanding issues. To forestall delay in the negotiating procedure, Travis Petty, chairman, president, and CEO of the El Paso Co., went to Algeria and discussed the incomplete negotiations with Minister Belkacem Nabi the following week. As a result of these discussions and communications with the new Administration, the next meeting was scheduled for Feb. 17 in Algeria.

The financial press reported that El Paso was delaying determination of its 1980 fourth-quarter and full-year earnings because of the meeting. But if the meeting fails to produce an "acceptable agreement," El Paso indicated it would have to determine the "appropriate valuation" of its LNG investment as of Dec. 31, 1980, "in light of the diminished prospects for project resumption."

After two days, the seventh and final government-to-government negotiations to resolve the price impass that had suspended deliveries under the El Paso project ended in failure on Feb. 18. No further negotiations were planned. As a result, the El Paso Co. announced that it would write down its investments and would eventually dissolve its El Paso LNG, El Paso Marine, and El Paso Algeria companies.

At the conclusion of the unsuccessful negotiations, an embassy spokesman commented that the two sides made a serious effort to reach settlement but "were unable to agree upon the complex energy policy issues involved in considering a governmental framework for this commercial transaction. No further inter-governmental meetings are planned."

El Paso's assets from the project included six operational and three non-operational LNG carriers and facilities related to the receiving terminals here and the export facility in Algeria.

All of the LNG carriers were placed on the market. The six operational carriers, which were either in layup in Greece or at shipyards in France undergoing repairs and modifications, were brought back to the U.S. for layup in Narragansett Bay. The three non-operational vessels were already in layup at Boston.

The parent companies of El Paso's customers (Columbia LNG Corp., Consolidated System LNG Co., and Southern Energy Co.) decided to negotiate directly with Algeria's Sonatrach after El Paso's decision to write off its LNG investment. They had decided not to write off their investments. In mid-April the three firms engaged the services of Warren M. Christopher who, as deputy secretary of state under President Carter, headed the successful U.S. negotiation team for the release of the hostages in Iran. After leaving Washington with the change in administration, Christopher had returned as a partner to the law firm of O'Melvany and Meyers in Los Angeles.

The first meeting on this company-to-company basis was held in Algiers on May 23 and 24. The atmosphere of this and subsequent negotiating sessions to date have been characterized as friendly and productive. To date, no agreement on a contract has been reached.

It is not really possible to categorically blame one side or another for the termination of a base-load LNG project for reasons other than the expiration of contract term. Perhaps the blame should rest with the United States government negotiators for a position on a net back price calculation that placed emphasis on an unreasonably low starting point. Perhaps it should lie with the Algerians who may have failed to realize the urgency for reaching agreement and need for compromise. The deed is done. Perhaps the industry will learn from it.

P&GJ

SCORECARD U.S. and Canadian LNG Peakshaving Facilities November 1981

Company and Plant Site	Liquefaction Plant Capacity, MMcfd day	Storage Capacity		Total Design Capacity	Regasification—MMcfd			Type of Storage Container	Storage Contractor	Liquefaction Plant Contractor	Type of Cycle	Year of Operation
		MMcf	MBbl		Runs	No. of Days	Type					
APCI-NEGEA Hopkinton Mass	18 5	2000 (2 at 290)	580	248	4 at 62	8	Submrgd	Aboveground 9% nickel	CBI	Cryo Methane	Cascade	1967 — plant 1971 on new tanks
APCI-NEGEA Hopkinton Mass	—	1000	290	—	—	—	—	Aboveground 9% nickel	CBI	—	—	1975 — third tank
ALABAMA GAS CORP Birmingham Ala	4 65	625	180	127 85	3 at 42 5	10	Submrgd	Aboveground 9% nickel	CBI	Air Products & Chemicals Inc	Cascade	1965
ALABAMA GAS CORP Birmingham Ala	—	625	180	42 5	1 at 42 5		Submrgd	Aboveground aluminum	CBI	—	—	1971 — second tank
ALABAMA GAS CORP Coosada Ala	2 7	600	175	80	2 at 40	15	Submrgd	Aboveground aluminum	CBI	CBI	Modified Cascade	1972
ATLANTA GAS LIGHT CO Riverdale Ga	10 0	1000	290	200	3 at 100	5	Uniflux	Aboveground aluminum	CBI	Air Liquide	TEAL Expander Process boost	1972
ATLANTA GAS LIGHT CO Riverdale Ga		1500	450	—	—	—	—	Aboveground 9% nickel	CBI	—	—	1973
ARKANSAS-MISSOURI POWER CO Yarbro Ark	0 66	374	110 (2 x 55)	66	2 at 33	6	Direct Fired	Aboveground aluminum	Brown Minneapolis Tank & Fab Co	Process Constructors Inc	Stirling	1973 — (1972 as satellite)
BALTIMORE GAS & ELEC CO Baltimore Md	2 75	500	145 (2 x 72 5)	187 5 125	3 at 62 5	5	Submrgd	Aboveground aluminum	CBI	CBI	Expander	1971
BALTIMORE GAS & ELEC CO PLANT No 2 Baltimore Md	2 4	500	145	62 5	1 at 62 5	8	Submrgd	Aboveground aluminum	CBI	CBI	MRL	1973
BAY STATE GAS CO Ludlow Mass	7 5	1000	290	55	1 at 25 2 at 15	35	Uniflux	Aboveground 9% nickel	CBI	J F Pritchard	PRICO	1973
BOSTON GAS CO Boston Mass	6 0	1000	290	187 5 125	3 at 62 5	8	Submrgd	Aboveground 9% nickel	CBI	CBI	Expander	1968
BOSTON GAS CO Boston Mass	—	1120	331	—				Aboveground aluminum	CBI	—		1971 — second tank
BOSTON GAS CO Lynn Mass	7 85	1000	290	86 4 57 6	3 at 28 8	12	Submrgd	Aboveground 9% nickel	PDM	Air Products & Chemicals Inc	MCR	1972
BRITISH COLUMBIA HYDRO AND POWER AUTHORITY Vancouver B C	2 5	625	180	150 100	3 at 50	6	Submrgd	Aboveground 9% nickel	Pittsburgh Des Moines Steel	Air Liquide	TEALARC	1971
BROOKLYN UNION GAS CO Brooklyn N Y	5 68	625	175	100	2 at 50	4	Direct Fired	Aboveground 9% nickel	CBI	American Messer	Expander	1968
BROOKLYN UNION GAS CO Brooklyn N Y	—	1000	290	50 125 175	2 at 25 2 at 62 5 2 at 62 5	—	Direct Fired Submrgd Submrgd	Aboveground 9% nickel	CBI		—	1971 — second tank 1979
CHATTANOOGA GAS CO Chattanooga Tenn	10 0	1200	348	90 60	3 at 30	20	Direct Fired	Aboveground 9% nickel	PDM	J F Pritchard	PRICO	1973
CITIZENS GAS & COKE UTILITY Beech Grove Ind	5 0	1000	290	180	3 at 60	5	Submrgd	Aboveground aluminum	PDM	Air Liquide	TEALARC	1972
COMMONWEALTH NATURAL GAS CO Tidewater Va	5 0	1200	348	105	3 at 35	12	Direct Fired	Aboveground 9% nickel	PDM	Envirogenics	Cascade	1972
CONNECTICUT NATURAL GAS CORP Rocky Hill Con	6 6	1200	348	80 55	2 at 25 1 at 30	24	Vapor Trufir Submrgd	Aboveground 9% nickel	PDM	Airco Cryoplants	Expander Nitrogen	1972
CONSOLIDATED EDISON CO Astoria N Y	6 0	1000	290	300 240	5 at 60	4	N A	Aboveground 9% nickel	PDM	Airco Cryoplants	Expander Nitrogen	1974
DELMARVA POWER & LT CO Wilmington Del	1 71	250	72 5	50	2 at 25	5	Direct Fired	Aboveground aluminum	CBI	Lotepro Linde AG	Expander Nitrogen	1972
EAST TENNESSEE NATURAL GAS CO Fordtown Tenn	5 5	1200	348	150	2 at 75	8	Direct Fired	Aboveground aluminum	CBI	CBI	MRL	1975
ENERGY TERMINAL SERVICES CORP Staten Island N Y	30 0	6000	1800	360	2 at 60 2 at 120	9	Direct Fired	Prestressed concrete	Preload Watch	NA	NA	1982 planned
(Conversion of part of terminal capacity to peakshaving Uses two storage tanks and all of vaporization capacity)												
FALL RIVER GAS CO Fall River Mass	0 5	150	45	10	1	15	Direct Fired	Aboveground 9% nickel	PDM	[illegible]	Dual J T Cycle	1970
GAS LIGHT CO OF COLUMBUS Columbus Ga	1 7	500	145	60	2 at 30	8	Indirect Fluid	Aboveground aluminum	CBI	CBI	Expander	1974
GAZ METROPOLITAIN INC Montreal Que Canada	10 0	1000	290	180	3 at 60	16	Submrgd	Aboveground 9% nickel	Horton (CBI)	Air Liquide	TEALARC	1969
GAZ METROPOLITAIN INC Montreal Que Canada	—	1000	290					Aboveground 9% nickel	Horton (CBI)			1972 — second tank
INTERMOUNTAIN GAS CO Boise Idaho	4 0	500	175	90 60	3 at 30	13	Submrgd	Aboveground aluminum	PDM	Lotepro Linde AG	Expander Nitrogen	1974
IOWA-ILLINOIS GAS & ELEC CO Bettendorf Iowa	2 0	500	145	50	2 at 25	10	Uniflux	Aboveground aluminum	CBI	CBI	MRL	1972
IOWA POWER & LT CO Des Moines Iowa	2 0	400	116	30	2 at 15	13	Intermed Fluid	Aboveground aluminum	CBI	CBI	MRL	1975
IOWA PUBLIC SERVICE CO Waterloo Iowa	2 5	400	117	30	2 at 15	26	Intermed Fluid	Aboveground aluminum	PDM	APCI (prime) Air Liquide (liquefaction)	TEALARC	1976
IOWA PUBLIC SERVICE CO Waterloo Iowa	—	400	117	—				Aboveground aluminum	CBI			1978 — second tank
KOKOMO GAS & FUEL CO Kokomo Ind	1 3	400	116	30 15	2 at 15	26	Intermed Fluid	Aboveground aluminum	CBI	CBI	Expander	1973
KOKOMO GAS & FUEL CO Kokomo Ind	1 25		—	—		—	—	(Second liquefaction unit)		CBI	MRL	1974
LONG ISLAND LIGHTING CO Holbrook N Y	3 0	600	175	200 150	4 at 50	4	Submrgd	Aboveground 9% nickel	PDM	Lotepro Linde AG	Cascade Mixed Refrigerant	1971
LOWELL GAS CO Lowell Mass	4 5	1000	290	70 70	2 at 30 1 at 10	16	Direct Fired	Aboveground 9% nickel	Graver Envirogenics	Envirogenics	Expander	1969
MEMPHIS LIGHT GAS & WATER DIV Memphis Tenn	5 0	1000	290	201	3 at 67	5	Submrgd	Aboveground 9% nickel	CBI	Air Liquide	Cascade	1967
METRO UTILITIES DISTRICT Omaha Nebr	6 0	1000	290	60 30	2 at 30	33	Submrgd	Aboveground 9% nickel	CBI	Lotepro Linde AG	Expander Nitrogen	1975
MINNESOTA GAS CO Burnsville Minn	5 0	1000	290	80	2 at 40	12	Intermed Fluid	Aboveground 9% nickel	CBI	CBI	MRL	1978
NORTHERN IND PUBLIC SERVICE CO La Porte Ind	10 0	2000	580	300 200	3 at 100	10	Direct Fired	Aboveground 9% nickel	CBI	J F Pritchard	PRICO	1974
NORTHERN IND PUBLIC SERVICE CO La Porte Ind	10 0	2000	580	300 200	3 at 100	10	Submrgd	Aboveground	CBI	Lotepro	Mixed Refrigerant	1981
NORTHERN & CENTRAL GAS CO Hagar Ontario	2 5	625	180	85	3 at 42 5	7	Submrgd	Aboveground 9% nickel	Horton (CBI)	Air Liquide	TEALARC	1968
NORTHERN & CENTRAL GAS CO Hagar Ontario	—	—	—	—	1 at 42 5	—	Submrgd	Aboveground 9% nickel	Horton (CBI)	Lotepro Engr		1977
NORTHERN NATURAL GAS CO Wrenshall Minn	10 0	2165	630	200	2 at 100	10	Submrgd	Aboveground 9% nickel	PDM	SD Plants	TEALARC	1975
NORTHERN NATURAL GAS CO Ventura Iowa	14 5	2165	630	300	3 at 100	7	Submrgd	Aboveground 9% nickel	PDM	NNG	PRICO	1978
NORTHERN STATES POWER CO Eau Claire Wisc	2 0	270	78	24 24	2 at 12 3 at 38	11	Direct Fired	Aboveground aluminum	CBI	CBI	Expander	1969
NORTHERN STATES POWER CO Wescott Minn	10 0	2130	580 (2 x 290) (1 x 32)	138	2 at 24	28	Direct Fired	Aboveground 9% nickel	CBI	CBI	MRL	1972 1975
NORTHWEST NATURAL GAS CO Portland Ore	2 5	625	175	200	2 at 60 1 at 20 2 at 30	10	Direct Fired Submrgd	Aboveground aluminum	CBI	CBI	Expander	1969
NORTHWEST NATURAL GAS CO Newport Ore	5 0	1200	348	100 100	2 at 50	12	Submrgd	Aboveground 9% nickel	CBI	CBI	MRL CRYEX	1977
NORTHWEST PIPELINE CORP Plymouth Wash	6 0	1200	348	225	3 at 75	8	Submrgd	Aboveground aluminum	PDM	Air Liquide	TEALARC	1975
NORTHWEST PIPELINE CORP Plymouth Wash	6 0	1200	348	75	1 at 75	15	Submrgd	Aboveground 9% nickel	PDM	Air Liquide	TEALARC	1979
PEOPLES GAS LIGHT & COKE Fisher Ill	10 0	2000	580 (2 x 290)	300 200	3 at 67 1 at 100	10	Direct Fired	Aboveground aluminum	CBI	CBI	Expander	1973
PHILADELPHIA ELECTRIC CO West Conshohocken Pa	6 6	1200	348	310 186	5 at 62	4	Submrgd	Aboveground 9% nickel	CBI	Airco Cryoplants	Expander Nitrogen	1972
PHILADELPHIA GAS WORKS Philadelphia Pa	25 0	4000	1166 (2 x 583)	500 400	5 at 100	10	Intermed Fluid	Aboveground Prestressed concrete	Preload	J F Pritchard	Cascade	1968 — Plant operable 1974 on tanks
PIEDMONT NATURAL GAS CO Charlotte N Car	5 0	1000	290	150	3 at 50	7	Direct Fired	Aboveground 9% nickel	CBI	CBI	MRL	1973

Cont'd U.S. and Canadian LNG Peakshaving Facilities

Company and Plant Site	Liquefaction Plant Capacity MMcfd day	Storage Capacity MMcf	Storage Capacity MBbl	Total Design Capacity	Regasification—MMcfd Runs	Regasification—MMcfd No. of Days	Regasification—MMcfd Type	Type of Storage Container	Storage Contractor	Liquefaction Plant Contractor	Type of Cycle	Year of Operation
PUBLIC SERVICE CO. OF NORTH CAROLINA, Cary, N.C.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Aboveground 9% nickel	CBI	CBI	MRC	[illegible]
ROANOKE GAS CO. Roanoke, Va.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Aboveground aluminum	CBI	CBI	MRC	[illegible]
SAN DIEGO GAS & ELECTRIC CO. Chula Vista, Calif. No. 1 Plant	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Submrgd	Aboveground 9% nickel	CBI	[illegible]	Expander	[illegible]
SAN DIEGO GAS & ELECTRIC CO. Chula Vista, Calif. No. 2 Plant	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Submrgd	Aboveground 9% nickel	CBI	[illegible]	Expander Nitrogen	[illegible]
SOUTH CAROLINA LNG CO. Bushy Park, So. Car.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Aboveground aluminum	PDM	[illegible]	[illegible]	[illegible]
SOUTHERN CONNECTICUT GAS CO., Milford, Conn.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] Submrgd	Aboveground 9% nickel	PDM	[illegible]	Expander Nitrogen	[illegible]
SOUTHWEST GAS CORP. Lovelock, Nev.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Submrgd	Aboveground 9% nickel	CBI	CBI	MRC	[illegible]
TENNESSEE NATURAL GAS LINES, INC., Nashville, Tenn.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Aboveground aluminum	CBI	CBI	MRC	[illegible]
TEXAS EASTERN TRANS. CO. Staten Island, N.Y.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Aboveground [illegible]	N.A.	[illegible]	[illegible]	[illegible] storage destroyed [illegible] new double-wall tank—planned on same foundation
TRANSCONTINENTAL GAS P.L. CORP., Hackensack, N.J.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	Aboveground aluminum	CBI	[illegible]	[illegible]	[illegible] new tank
TRANSCONTINENTAL GAS P.L. CORP., Hackensack, N.J.		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	Aboveground 9% nickel	PDM			[illegible] second tank
UGI CORP. Temple, Pa.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Submrgd	Aboveground 9% nickel	PDM	[illegible]	Expander	[illegible]
UTILITIES BOARD Trussville, Ala.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	Aboveground aluminum	CBI	CBI	MRC [illegible]	[illegible]
WISCONSIN NATURAL GAS CO. Oak Creek, Wisc.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Aboveground aluminum	CBI	CBI	Cascade	[illegible]

International LNG Peakshaving Facilities

Company and Plant Site	Liquefaction Plant Capacity MMcfd day	Storage Capacity MMcf	Storage Capacity MBbl	Total Design Capacity	Regasification—MMcfd Runs	Regasification—MMcfd No. of Days	Regasification—MMcfd Type	Type of Storage Container	Storage Contractor	Liquefaction Plant Contractor	Type of Cycle	Year of Operation
BRITISH GAS CORP. Avonmouth, Avon	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Submrgd	Aboveground aluminum	Whessoe, Ltd.	Cryoplants, Ltd.	MCR	[illegible]—Plant [illegible]—Tank
BRITISH GAS CORP. Avonmouth, Avon		[illegible]	[illegible]	[illegible]	[illegible]		Submrgd	Aboveground 9% nickel	Motherwell Bridge Engrg. Ltd.			[illegible]—Second tank
BRITISH GAS CORP. Glenmavis, Scotland	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Submrgd	Aboveground 9% nickel	Motherwell Bridge Engrg. Ltd.	Cryoplants, Ltd.	MCR	[illegible] (North Sea Gas)
BRITISH GAS CORP. Glenmavis, Scotland (2nd plant)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Submrgd	Aboveground 9% nickel	Motherwell Bridge Engrg. Ltd.	Cryoplants, Ltd.	MRC	[illegible]
BRITISH GAS CORP. Partington, Cheshire, England	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Submrgd	Aboveground 9% nickel	[illegible]	Cryoplants, Ltd.	MRC	[illegible]
BRITISH GAS CORP. Partington, Cheshire, England (2nd plant)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		Submrgd	Aboveground aluminum	Whessoe, Ltd.	Cryoplants, Ltd.	MRC	[illegible] tank [illegible] plant
BRITISH GAS CORP. Isle of Grain, Kent	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Aboveground 9% nickel	Motherwell Bridge Engrg. Ltd.	[illegible]	[illegible] Expander	[illegible]
BRITISH GAS CORP. Isle of Grain, Kent	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Aboveground 9% nickel	Whessoe, Ltd.	[illegible]	Nitrogen Expander	[illegible]—Planned
BRITISH GAS CORP. Dynevor Arms, S. Wales	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N.A.	Aboveground	N.A.	[illegible]	MCR	[illegible]—Planned
BRITISH GAS CORP. Canvey Island, England	[illegible]				[illegible]					Air Products, Ltd.	[illegible]	[illegible]
N.V. NEDERLANDSE GASUNIE Maasvlakte, The Netherlands	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Submrgd	Aboveground 9% nickel	[illegible]	Linde A.G.	Expander Nitrogen	[illegible]
DISTRIGAZ, S.A. Zeebrugge, Belgium	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Submrgd	Aboveground 9% nickel	[illegible]	Linde A.G.	Nitrogen Expander	[illegible]
STUTTGART CITY UTILITIES Stuttgart, W. Germany	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Submrgd	Aboveground 9% nickel	Linde A.G.	Linde A.G.	[illegible]	[illegible]—Peakshaving plant
THYSSEN GAS GmbH Duisburg, Hamborn, W. Germany	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Submrgd	Aboveground 9% nickel	CBI	CBI	MRC	[illegible]
GAS & FUEL CORP. OF VICTORIA Dandenong, Victoria, Australia	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Submrgd	Aboveground 9% nickel	[illegible]	Cryoplants, Ltd.	MRC	[illegible]

EUROPEAN SATELLITE PEAKSHAVING FACILITIES

Company	Plant Location	LNG Source	Storage Volume MMcf	Storage Volume MBbl	Sendout Capacity MMcf day	Type of Storage Container	Storage Contractor	Systems Contractor	Year of Operation
British Gas Corp.	Ambergate, Derbyshire, England	Imported LNG (from Canvey Island)	[illegible]	[illegible]	[illegible]	[illegible] aluminum	Whessoe, Ltd.	Whessoe, Ltd. (Hercules Expander Reliquefaction)	[illegible]
British Gas Corp.	Amlwch, Anglesey, Wales, U.K.	British Gas Corp. (Glenmavis, Scotland)	[illegible]	[illegible]	[illegible]	Shop fabricated 9% nickel	Air Products, Ltd.	British Gas Corp. Wales Region	[illegible]
British Gas Corp.	Stranraer, Wigtownshire, Scotland, U.K.	British Gas Corp. (Glenmavis, Scotland)	[illegible]	[illegible]	[illegible]	Shop fabricated stainless steel	Cryoplants, Ltd.	British Gas Corp. Scottish Region	[illegible]
British Gas Corp.	Oban, Argyll, Scotland, U.K.	British Gas Corp. (Glenmavis, Scotland)	[illegible]	[illegible]	[illegible]	Shop fabricated [illegible]	[illegible], Ltd. Air Products, Ltd.	British Gas Corp. Scottish Region	[illegible]
British Gas Corp.	Tobermory, Mull, Scotland, U.K.	British Gas Corp. (Glenmavis, Scotland)	[illegible]	[illegible]	[illegible]	Shop fabricated 9% nickel	Air Products, Ltd.	British Gas Corp. Scottish Region	[illegible]
British Gas Corp.	[illegible], Argyll, Scotland, U.K.	British Gas Corp. (Glenmavis, Scotland)	[illegible]	[illegible]	[illegible]	Shop fabricated 9% nickel	Air Products, Ltd.	British Gas Corp. Scottish Region	[illegible]
British Gas Corp.	[illegible], Ross, Scotland, U.K.	British Gas Corp. (Glenmavis, Scotland)	[illegible]	[illegible]	[illegible]	Shop fabricated stainless steel	Cryoplants, Ltd.	British Gas Corp. Scottish Region	[illegible]
British Gas Corp.	Campbeltown, Argyll, Scotland, U.K.	British Gas Corp. (Glenmavis, Scotland)	[illegible]	[illegible]	[illegible]	Shop fabricated [illegible] tank 9% nickel [illegible] tank stainless steel	Air Products, Ltd. Cryoplants, Ltd.	British Gas Corp. Scottish Region	[illegible]
British Gas Corp.	Moffat, Dumfriesshire, Scotland, U.K.	British Gas Corp. (Glenmavis, Scotland)	[illegible]	[illegible]	[illegible]	Shop fabricated stainless steel	Cryoplants, Ltd.	British Gas Corp. Scottish Region	[illegible]

Cont'd EUROPEAN SATELLITE PEAKSHAVING FACILITIES

Company	Plant Location	LNG Source	Storage Volume MMcf	Storage Volume MBbl	Sendout Capacity MMcf/day	Type of Storage Container	Storage Contractor	Systems Contractor	Year of Operation
Gaz de France	Nantes, Loire-Atlantique, France	Gaz de France [illegible], France	50.3	15.7	17.0	Field erected 1 tank, 9% nickel 3145 bbl; 1 tank concrete invar 12,579 bbl	Creusot-Loire Gaz Transport	Gaz de France	1966
Gaz de France	[illegible], France	Gaz de France Le Havre, France	11.7	[illegible]	35.3	Field erected 9% nickel	Bignier Schmid Laurent	Gaz de France	1976
Erdgas Südbayern GmbH	[illegible], W. Germany	Technische Werke der Stadt Stuttgart W. Germany	[illegible]	3.629	[illegible]	Shop fabricated	Linde AG	Linde AG	1974
Technische Werke der Stadt Stuttgart	[illegible]	Technische Werke der Stadt Stuttgart W. Germany	1.980	0.258	1.448	Truck transport	Linde AG and Aurepa	Technische Werke der Stadt Stuttgart	1976
Thyssengas GmbH	[illegible]	Thyssengas Duisburg-Hamborn W. Germany	0.845	0.186	0.848	Truck transport	Aurepa	Thyssengas	1977
Gas Figueras S.A.	[illegible], Spain	ENAGAS Barcelona, Spain	2.383	1.26	[illegible]	Shop fabricated stainless steel	Meccanicos de la Pena	Enagas	1971
Gas Costa Brava S.A.	[illegible], Spain	ENAGAS Barcelona, Spain	2.87	[illegible]	[illegible]	Shop fabricated stainless steel	Maquinista Terrestre y Maritima	British Oxygen	1977
Gas Sabadellense S.A.	[illegible], Spain	ENAGAS Barcelona, Spain	1.345	0.379	[illegible]	Shop fabricated stainless steel	Air Liquide Spain	Air Liquide Spain	1977
Sugranes Gas Ciclope S.A.	[illegible], Spain	ENAGAS Barcelona, Spain	3.062	1.010	0.144	Shop fabricated stainless steel	Air Liquide Spain	Air Liquide Spain	1973
Gerona Gas S.A.	Gerona, Spain	ENAGAS Barcelona, Spain	1.754	0.504	[illegible]	Shop fabricated stainless steel	Maquinista Terrestre y Maritima	British Oxygen	1977
Gas Onda S.A.	[illegible], Spain	ENAGAS Barcelona, Spain	1.315	0.378	N.A.	Shop fabricated stainless steel	N.A.	N.A.	1977
Termica Cybersa	Tarragona, Spain	ENAGAS Barcelona, Spain	0.448	0.126	0.009	Shop fabricated stainless steel	Air Liquide Española	Air Liquide Española	1978

NA — Not Available

LNG Satellite Peakshaving Facilities Small Capacity Plants — Shop Builtup Components

Company	Plant Location	LNG Source	Storage Volume MMcf	Storage Volume M gal	Sendout Capacity MMcf/day	Type of Storage Container	Storage Contractor	Systems Contractor	Year of Operation
Bay State Gas Co.	Marshfield, Mass.	Bay State [illegible]	4.0	110	10.0	Shop builtup cylinders	Process Eng.	Gas, Inc.	1971
City of Brownsville Gas Dept.	Brownsville, Tenn.	Memphis LG&W	1.1	[illegible]	10.0	Trailer shuttle	Ryan Industries	City of B'ville Gas Dept.	1970
Cape Cod Gas Co.	South Yarmouth, Mass.	Lowell Gas Co.	3.3	84.5	7.8	Shop builtup cylinder	Process Eng.	Process Eng.	1970
Cape Cod Gas Co.	Wareham, Mass.	Lowell Gas Co.	4.0	110	2.6	Shop builtup cylinder	Process Eng.	Gas, Inc.	1974, 1978
Concord Natural Gas Corp.	Concord, N.H.	Bay State Gas Co.	2.1	[illegible]	3.6	Shop builtup cylinders	Process Eng.	Gas, Inc.	1974
Consumers Gas Co.	[illegible]	[illegible]	4.1	[illegible]	3.8	Shop builtup cylinders	Process Eng.	Gas, Inc.	1978
DeKalb Cherokee Counties Gas District	Fort Payne, Ala.	Chattanooga Gas Co.	[illegible]	[illegible]	2.0	Shop builtup cylinders	LNG Equip.	Lobb Eng. Assoc.	1972
Elizabethtown Gas Co.	Hackettstown, N.J.	[illegible]	—	[illegible]	6.9	Shop builtup cylinder	Process Eng.	PSM	1971
Fitchburg Gas & Electric Light	Westminster, Mass.	Lowell Gas Co.	2.0	[illegible]	5.0	Shop builtup cylinders	Process Eng.	Gas, Inc.	1974
Gas Service Inc.	Nashua, N.H.	New England LNG	4.0	[illegible]	7.0	Shop builtup cylinders	Process Eng.	Gas, Inc.	1973
Holyoke Gas Department	Holyoke, Mass.	Lowell Gas Co.	[illegible]	[illegible]	12.0	Shop builtup cylinders	Process Eng.	Gas, Inc.	1971
Lawrence Gas Co.	Lawrence, Mass.	Lowell Gas Co.	[illegible]	[illegible]	16.0	Shop builtup cylinder	H. T. [illegible]	Gas, Inc. and Smith & Normington	1969, 1972
Lowell Gas Co.	Wilmington, Mass.	Lowell Gas Co.	[illegible]	40	17.0	Shop builtup cylinders	H. T. [illegible]	Gas, Inc.	1971
Lowell Gas Co.	Westford, Mass.	Lowell Gas Co.	4.0	79	8.7	Shop builtup cylinder	Process Eng.	Gas, Inc.	1972, 1974
Manchester Gas Co.	Manchester, N.H.	New England LNG Co.	4.0	[illegible]	4.0	Shop builtup cylinders	Process Eng.	Process Eng.	1975
Middleboro Gas & Electric Dept.	Middleboro, Mass.	Lowell Gas Co.	2.5	81	5.0	Shop builtup cylinder	Process Eng.	Gas, Inc.	1970
Hartford Elec. Lt. Co.	Torrington, Conn.	Distrigas & New England LNG Co.	4.0	32	[illegible]	Shop builtup cylinder	Ryan Industries	N. E. Utilities	1972
Hartford Elec. Lt. Co.	Stamford, Conn.	Distrigas & New England LNG Co.	4.3	38	4.8	Shop builtup cylinders	Ryan Industries	N. E. Utilities	1972
Hartford Elec. Lt. Co.	Danbury, Conn.	Distrigas & New England LNG Co.	3.8	110	3.8	Shop builtup cylinders	Ryan Industries	N. E. Utilities	1972
Connecticut Lt. & Power Co.	Montville, Conn.	Distrigas & New England LNG Co.	4.5	55	2.2	Shop builtup cylinders	Process Eng.	Gas, Inc.	1972
Connecticut Lt. & Power Co.	Waterbury, Conn.	Distrigas & New England LNG Co.	17.4	165	7.2	Shop builtup cylinders	Ryan Industries	N. E. Utilities	1972
Connecticut Lt. & Power Co.	Norwalk, Conn.	Distrigas & New England LNG Co.	4.1	56	2.4	Shop builtup cylinders	Ryan Industries	Conn. L&P	1975
Northern Utilities Co.	[illegible], Me.	New England LNG Co.	12.4	N.A.	[illegible]	Shop builtup cylinders	Process Eng.	Applied Engineering, Gas, Inc.	1971, 1975, 1977
City of Norwich (Conn.) Dept. of Public Utilities	Norwich, Conn.	New England LNG Co.	4.3	55	11.2	Shop builtup cylinders	Process Eng.	Gas, Inc.	1972
Piedmont Natural Gas Company	[illegible], N.C.	American LNG Corp.	4.5	56	7.7	Shop builtup cylinders	Process Eng.	Process Eng.	1971
Savannah Public Utility Dept.	Savannah, Tenn.	Chattanooga Gas Co.	3.85	11	1.5	Trailer shuttle	Process Eng.	Process Eng.	1973
United Cities Gas Co.	Murfreesboro, Tenn.	Chattanooga Gas Co.	4.5	36	8.2	Shop builtup cylinders	Process Eng.	Process Eng.	1973
UGI Corporation	Hazleton, Pa. (portable)	UGI Corp. Temple, Pa.	3.85	41	2.0	Trailer shuttle	Process Eng.	Cosmodyne	1974
Westfield Gas Dept.	Westfield, Mass.	Lowell Gas Co.	4.0	110	12.0	Shop builtup cylinders	Process Eng.	Gas, Inc.	1971, 1974
Wisconsin Gas Co.	Blue Lake, Wis.	Northern States Power	16.0	230	7.2	Shop builtup cylinders	Process Eng.	Gas, Inc.	1974
Middle Tennessee Natural Gas Authority	Smithville, Tenn.	Memphis LG&W Div.	1.8	22	0.08	Trailer shuttle	American LNG Co.	American LNG Co.	1975

LNG Satellite Facilities in Japan

Company	Plant Location	LNG Source	Storage Volume MMcf	Storage Volume MBbl	Sendout Capacity MMcf Day	Type of Storage Container	Storage Contractor	Systems Contractor	Year of Operation
Tokyo Gas Co.	Hitachi, Ibaraki	Tokyo Gas Co. Negishi Sodegaura	31.8	9.20 (1 × 8.82) (1 × 0.38)	110: 2 × 22 7 × 89	Field erected Shop fabricated	Hitachi Nippon Oxygen	Tokyo Gas Company	1970
Washinomiya Gas Co.	Washinomiya, Saitama	Tokyo Gas Co. Negishi Sodegaura	0.77	0.229 (2 × 0.115)	33: 3 × 11	Shop fabricated	Tokyo Oxygen	Tokyo Gas Company	1971
[illegible] Gas Co.	Higashimatsuyama, Saitama	Tokyo Gas Co. Negishi Sodegaura	0.43	0.126 (2 × 0.063)	10: 2 × 5	Shop fabricated	Nippon Oxygen	Tokyo Gas Company	1975
Mito Gas Co.	Mito, Ibaraki	Tokyo Gas Co. Negishi Sodegaura	1.29	0.378 (3 × 0.126)	66: 3 × 22	Shop fabricated	Nippon Oxygen	Tokyo Gas Company	1977
Tokyo Gas Co.	Kofu, [illegible]	Tokyo Gas Co. Negishi	1.72	0.503	N.A.	Shop fabricated	Tokyo Oxygen [illegible]	Tokyo Gas Company	1981

LNG Satellite Peakshaving Facilities Large Capacity Plants — Field Construcⁱed K.D. Components

Company	Plant Location	LNG Source	Storage Volume MMcf	Storage Volume MBbl	Sendout Capacity MMcf day	Type of Storage Container	Storage Contractor	Systems Contractor	Year of Operation
Atlanta Gas Light Co.	Macon, Ga.	Southern Energy	1500	450.0	180.0	Aboveground aluminum	CBI	Applied Engineering	1972
Austell Gas Dept.	Austell, Ga.	American LNG Corp.	80	[illegible]	[illegible]	Aboveground aluminum sphere	CBI	CBI	1977
Bay State Gas Co.	Easton, Mass.	Distrigas	[illegible]	[illegible]	[illegible]	Aboveground aluminum	CBI	CBI	1972
Boston Gas Co.	Salem, Mass.	Boston Gas	[illegible]	240.0	[illegible]	Aboveground 9% nickel	PDM	PDM	1972
Cape Cod Gas Co.	South Yarmouth, Mass.	[illegible]	[illegible]	[illegible]	[illegible]	Prestressed concrete w/ liner	[illegible]	[illegible]	1971
Chicago Bridge & Iron Co.	Cordova, Ala.	American LNG Corp.	[illegible]	[illegible]	[illegible]	Aboveground aluminum sphere	CBI	CBI	1975
Elizabethtown Gas Co.	Elizabeth, N.J.	[illegible]	[illegible]	[illegible]	[illegible]	Aboveground aluminum	PDM	PDM	1972
Fort Hill Natural Gas Authority	Fort Hill, S.C.	American LNG Corp.	[illegible]	[illegible]	[illegible]	Aboveground aluminum sphere	CBI	CBI	[illegible]
Haverhill Gas Co.	Haverhill, Mass.	Distrigas	[illegible]	[illegible]	[illegible]	Aboveground aluminum	CBI	CBI	1972
Lynchburg Gas Co.	Lynchburg, Va.	[illegible]	[illegible]	[illegible]	[illegible]	Aboveground aluminum sphere	[illegible]	[illegible]	[illegible]
New Bedford Gas & Edison Light Co.	Acushnet, Mass.	Hopkinton LNG Corp.	[illegible]	[illegible]	[illegible]	Aboveground 9% nickel	PDM	[illegible]	1971
New Bedford Gas & Edison Light Co.	Acushnet, Mass.	Hopkinton LNG Corp.	[illegible]	[illegible]		Aboveground aluminum	CBI		1973 2nd tank
New Jersey Natural Gas Co.	Stafford Township, N.J.	[illegible]	[illegible]	[illegible]	[illegible]	Aboveground aluminum	CBI	CBI	1971
New Jersey Natural Gas Co.	Howell Township, N.J.	[illegible]	[illegible]	[illegible]	[illegible]	Aboveground aluminum	PDM	PDM	1973
Northern States Power Co.	[illegible], Wis.	NSP	[illegible]	[illegible]	[illegible]	Aboveground aluminum	CBI	CBI	[illegible]
Philadelphia Gas Works	Philadelphia, Pa.	PGW	[illegible]	[illegible]	[illegible]	Aboveground 9% nickel	PDM	[illegible]	1971
Providence Gas Co.	Exeter, R.I.	Distrigas	[illegible]	[illegible]	[illegible]	Aboveground aluminum	[illegible]	[illegible]	1972
Public Service Gas & Electric Co.	Burlington Township, N.J.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] aluminum	CBI	[illegible]	1972
Springfield Gas Utility	Springfield, Tenn.	[illegible]	[illegible]	[illegible]	[illegible]	Aboveground aluminum sphere	PDM	PDM	1974
South Jersey Gas Co.	McKee City, N.J.	Distrigas	[illegible]	[illegible]	[illegible]	Aboveground aluminum	CBI	CBI	1972
Valley Gas Co.	Cumberland, R.I.	New England LNG Co.	[illegible]	[illegible]	[illegible]	Prestressed concrete w/ liner	[illegible]	[illegible]	1971

U.S. Remote Supply Projects

Company	Plant Location	Origin of Liquid	Site Storage M gal	Site Vaporization Mcf hr
San Diego Gas & Electric Co.	Borrego Springs, Calif.	Peakshaving facility at Chula Vista, Calif.	[illegible]	[illegible]
San Diego Gas & Electric Co.	Alpine Village, Calif.	Peakshaving facility at Chula Vista, Calif.	[illegible]	[illegible]
San Diego Gas & Electric Co.	Camp Pendleton, Calif.	Peakshaving facility at Chula Vista, Calif.	[illegible]	[illegible]

International Baseload LNG Liquefaction Facilities

Company and Plant Site	Liquefaction Plant Capacity MMcf day	Storage Capacity MMcf	Storage Capacity MBbl	Type of Storage Container	Storage Contractor	Liquefaction Plant Contractor	Type of Cycle	Year of Operation
ARCTIC PILOT PROJECT Bridport Inlet Melville Island, Canada	[illegible] Barge mounted	N.A.	[illegible]	N.A.	N.A.	N.A.	[illegible]	1985
CAMEL (GL 4-Z) Arzew, Algeria	[illegible]	[illegible]	[illegible]	Aboveground (2 aluminum, 1 9% nickel) Frozen hole	CBI [illegible] [illegible]	Technip [illegible]	[illegible]	[illegible]
SONATRACH — (GL 1-Z) Arzew, Algeria	[illegible]	[illegible]	[illegible]	Aboveground 9% nickel	[illegible] PDM	[illegible]	[illegible] MCR	1978
SONATRACH — (GL 2-Z) Arzew, Algeria	[illegible]	[illegible]	[illegible]	Aboveground 9% nickel	[illegible] PDM	Pullman Kellogg	[illegible] MCR	[illegible]
SONATRACH — (GL 1-K) Skikda, Algeria	[illegible]	[illegible]	[illegible]	Aboveground 9% nickel	[illegible]	Technip	[illegible]	1972
SONATRACH — (GL 2-K) Skikda, Algeria	[illegible]	[illegible]	[illegible]	Aboveground 9% nickel	CBI	Pullman Kellogg	[illegible]	1981
SONATRACH — (GL 3-K) Skikda, Algeria	[illegible]	[illegible]	[illegible]	Aboveground 9% nickel	CBI [illegible]	Pullman Kellogg	[illegible]	[illegible]
ESSO LIBYA Marsa el Brega, Libya	[illegible]	[illegible]	[illegible]	Aboveground 9% nickel	CBI	Esso R&E Service SNAM Progetti	[illegible] MCR	1970
BRUNEI LNG Lumut, Brunei, Borneo	[illegible]	[illegible]	[illegible]	Aboveground 9% nickel	[illegible] PDM	[illegible]	APCI MCR	1973
ABU DHABI GAS LIQUEFACTION CO. LTD., Das Island, Abu Dhabi	[illegible]	[illegible]	[illegible]	Aboveground 9% nickel	[illegible]	[illegible]	APCI MCR	1977
ABU DHABI GAS LIQUEFACTION CO. LTD., Das Island, Abu Dhabi		[illegible]	[illegible]	Compound	CBI			1985 [illegible] Replacement for existing storage
PHILLIPS-MARATHON Kenai, Alaska	[illegible]	[illegible]	[illegible]	Aboveground aluminum	CBI	Phillips-Bechtel	Cascade	1969
PERTAMINA MOBIL Arun, N. Sumatra, Indonesia	[illegible]	[illegible]	[illegible]	Aboveground 9% nickel	[illegible] PDM	Bechtel [illegible]	APCI MCR	[illegible]
PERTAMINA HUFFCO Badak, E. Kalimantan, Indonesia	[illegible]	[illegible]	[illegible]	Aboveground 9% nickel	Hitachi Zosen [illegible] CBI	Bechtel [illegible]	APCI MCR	1977
PERTAMINA HUFFCO Badak, E. Kalimantan, Indonesia (expansion)	[illegible]	[illegible]	[illegible]	Aboveground 9% nickel	N.A.	Bechtel [illegible]	APCI MCR	1983 — U.C.
GAS DE CHILE (ENAP) Cabo Negro, Chile	[illegible]	N.A.	N.A.	N.A.	N.A.	[illegible]	APCI MCR	1983 — Planned
MALAYSIAN LNG SDN. BHD. Bintulu, Sarawak, Malaysia	[illegible]	[illegible]	[illegible]	N.A.	[illegible]	Pullman Kellogg [illegible]	APCI MCR	1982 — U.C.
BONNY LNG Bonny, Nigeria	[illegible]	N.A.	N.A.	N.A.	N.A.	[illegible]	[illegible]	[illegible] — Planned
WOODSIDE LNG PTY. LTD. Withnell Bay Western Australia	[illegible]	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	[illegible]

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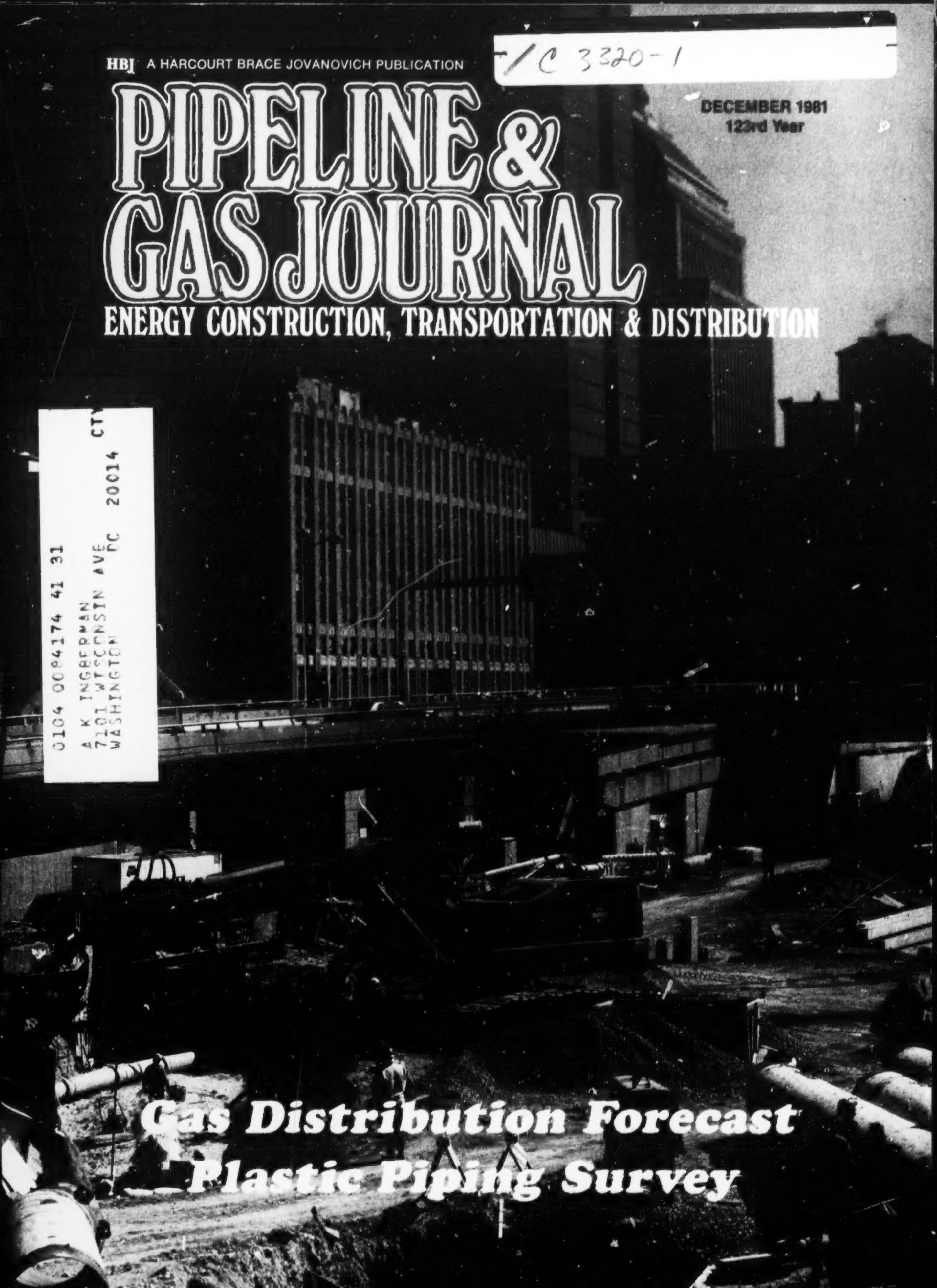

Gas Distribution Forecast

Plastic Piping Survey

PIPELINE & GAS JOURNAL

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COVER
Pipelining in a big and historic city such as Boston is considerably different from conventional cross-country pipelining; how it differs and other details of pipeline work at Copley Square project are reported in this issue.

—Photograph courtesy of Bond Brothers, Inc.

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New and replacement mains and services are needed to adequately serve the 48.8 million U.S. gas customers, as the nation's gas utilities expect to spend $2.651 billion to bring gas to homes, businesses, and factories in 1982.

Distribution Forecast

Gas Utility Piping Outlay To Top $2.65 Billion In 1982

by **Dean Hale**, *Editor*

Gas distribution utilities in the U.S. set a record in 1981 for capital expenditures for gas piping by spending a total of $2,406,258,480 – and by adding 685,000 new customers, many of them conversion customers from fuel oil or electricity, to boost the national gas customer total to 48,800,000.

While it was a record year in terms of dollar expenditures – up 34.7% over the sum spent in 1980 – the nation's 1560 gas utilities added 24,723 miles of mains and service lines, down 11.6% from the 1980 totals, a decline attributed to a continuing decline in new housing starts.

For 1982, the projection is for a 10.3% increase in capital expenditures – to $2.651 billion – to provide the facilities for adding an estimated 500,000 to 600,000 new customers during the year and to provide facilities for system upgrading and maintenance.

As revealed by PIPELINE & GAS JOURNAL's 16th annual survey of gas distribution utilities, the gas distribution utility industry spent $1.524 billion for new and replacement mains and service lines in 1981, and spent $881 million for maintenance of system duing the year. Those expenditures produced 11,535 miles of new and replacement gas mains and 13,188 miles of new and replacement gas service lines.

The 1982 projection, for 25,167 miles of mains and services to be installed, is 1.7% above the amount installed in 1981, while expenditures increase 10.3% over 1981 outlays. The rapidly increasing costs reflect an unceasing inflationary trend in labor, materials, and construction equipment.

Even though the economy slowed materially in the final two quarters of 1981, gas utilities had a generally good year in terms of new customers attached and that is reflected in the amount of new piping installed to provide that service. Biggest surprise is in the amount expended for system maintenance and upgrading – $881 million in 1981 vs. $629 million in 1980, an increase of 40%. For 1982, system maintenance expenditures will rise another 10% – $969,765,390. The 685,000 customers added in 1981 are only 83.5% of the number added in 1980, but are still considered substantial and the number is very close to the 650,000 to 750,000 estimated at this time last year.

For 1982, gas utilities expect to add about 500,000 to 600,000 more customers (assuming that new housing starts will pick up no later than the second quarter of 1982) and assuming that conversion of oil and electric customers to gas and gas heat continue at a moderate rate. With fuel oil and electricity rates still very high, and the prospects for total gas deregulation not so probable in 1982, the customer conversion prospects appear good.

During 1982, according to P&GJ's survey, 11,672 miles of new and replacement mains and 13,495 miles of new and replacement service lines will be installed. Projected 1982 expenditures are $2,651,460,490, of which $1.681 billion will be spent for new and replacement mains and services and $969 million will be spent on maintenance of system. All

Not all gas lines are installed in warm spring and summer months . . . here, workmen from Philadelphia Electric Co. weld pipe on new line installed in PE's service area to increase system reliability.

projections are in terms of 1981 dollars.

Data for the 1981 and 1982 expenditure and pipe mileage projections were compiled in a survey of 500 gas distribution utilities in 50 states, including the 300 largest gas distribution utilities as reported in THE P&GJ 500 (August 1981 issue). Responses on expenditures, planned installations, and operating and engineering conditions were supplied by utility management, engineering, and operating personnel.

Gas Distribution Utility Expenditures

	Expenditures 1980	 1981	 1982 est.
New and replacement mains and service lines	$1,157,005,400	$1,524,783,000	$1,681,695,100
Maintenance of system	629,100,520	881,475,480	969,765,390
TOTALS	$1,786,105,920	$2,406,258,480	$2,651,460,490

Gas Distribution Utilities Pipe Installed

	Piping Installed, Miles 1979	 1980	 1981	 1982 est.
Gas Mains	13,319	13.573	11,535	11,672
Gas service lines ..	13,652	14,379	13,188	13,495
TOTALS	26,971	27,952	24,723	25,167

Gas Distribution Utilities – Pipe Installed – Total "In Ground" – As of 12-31-81

Gas Mains	831,733
Gas Service Lines	525,601
	1,357,334

1982 Programs A Mixed Bag

Gas utility managers and operating personnel, in addition to providing hard data on their company pipe mileage installations and dollar expenditures, also commented on their 1981 programs and what they expect for 1982. Responses to the 16th annual P&GJ survey included these comments:

"We expect 1982 activity to be about same as 1981."

"No significant increases. Plans for 1982 are for approximately same amount of activity as in 1981."

"Our construction in 1981 decreased 75% from projections, but will be up 10% in 1982."

"Our construction and maintenance programs have remained level for past four years and we expect that level to continue into and through 1982."

"We added 15,500 ft of 6-in. main in 1981; we expect to add 5500 ft more in 1982."

"We are upgrading old mains and replacing a portion of our older lines each year."

"Our expenditures up about 6% in 1981 and will be up 6% in 1982."

"We plan to attach customers at the same rate in 1982 as we did in 1981; our construction program has increased as a result of new business – about 10% per year."

"No increase but we are holding about normal in terms of construction and customer additions; our area has sustained a steady rate of growth."

"We are in the middle of a 10-year program to replace our old low pressure system with a new system. One result is that we see a decline in maintenance expense."

"Construction has decreased and maintenance increased. Do not see any increase in construction for 1982."

"Our work level in 1981 for new mains and services was up 50% and for 1982 we foresee an increase of 25%."

"Expenditures in all areas are fairly constant."

Interest, Inflation Affect Programs

"Our construction program has almost come to a halt because home building is very slow; our maintenance program continues to increase materially as our system is old and much of it is unprotected steel that we are replacing."

"Customer contributions in aid to construction have been increased; any necessary maintenance is being done."

"High interest rates have depressed new home construction and reduced subdivision development – and our need to extend our distribution system."

"New service for residential builders has slowed and higher costs have reduced the length of main/service feasible to extend to new customers; necessary maintenance has not been reduced, though."

"Our revenue is down about 10% and less construction is needed; we do have more maintenance commitments – up at least 6%."

Southern California Gas Co. crews install plastic service line to new condominium development in the Palm Springs area.

"We are performing more maintenance than ever because new construction is down drastically."

Gas Supply Problems Few

"No supply problems yet; we seek two appliances on every new service/main extension."

"Restrictions are limited by the economic feasibility of projects to add customers."

"Only restrictions on customer attachments is that we do not attach more load than our suppliers will allow gas for . . . currently have no major supply problems."

"No restrictions on connecting new customers."

"Firm customers are limited to 25 Mcf per day of connected load."

"Presently we limit to 50 Mcf per day on firm gas basis."

"Any load over 1000 cfh must be interruptible."

"We have no restrictions on residential attachments – but we do have on commercial and industrial usage."

"No problems of gas supply, and we don't expect any."

Some Procedure Changes

P&GJ asked respondents to comment on any major changes in their construction, maintenance, or repair procedures that are a result of recent federal, state or local safety regulations. Here are the answers:

"Have greatly expanded the continuing maintenance of our LNG facility."

"Now have qualification procedures for employees who make fusion joints and mechanical joints on plastic pipe."

"We now use plastic pipe for replacement services on certain steel mains; more of our steel mains are now cathodically protected and we have expanded our testing for cathodic protection interference.

"We plan to get all records on the computer for better availability and analysis."

"Heavy emphasis has been placed on maintenance of the cathodic protection system and on replacement of existing steel lines."

"Bare steel mains are being replaced at an accelerated rate."

"We have change procedures for qualifying employees and contractors who inspect and who install pipe."

"We now have improved valve maintenance, corrosion, and leak survey programs."

"We have increased staff to accommodate record-keeping and the increased number of surveys of our system. Staff is doing more in-house training."

'Wanted' New Products Listed

Respondents to P&GJ's 16th annual piping survey were also asked to list new piping products most wanted – or evolved from research. They include:

- Plastic valves with higher pressure ratings.
- Improved plastic pipe location techniques.
- Improved odorant injection techniques.
- Line stopping equipment for 4 and 6-in. plastic pipe.
- A full flow (full opening) fitting to put on mains for attaching services.
- An epoxy material (or something similar) to seal joint leaks in 25 psig cast iron piping system.
- Non-destructive testing methods for plastic fusion joints.
- Increased maximum allowable operating pressure (MAOP) for plastic pipe.
- A plastic patch repair sleeve that can be installed without shutting down the main.
- A clamp-on service saddle made of tough plastic material (such as Zytel) in sizes to 8-in. main.
- Non-metallic, non-mechanical 3 and 4-in. repair couplings.

P&GJ

Plastic Pipe Continues Phenomenal Growth

by Dean Hale, *Editor*

Plastic pipe, for the second year in a row, has accounted for over 75% of all of the pipe installed by the nation's gas distribution utilities – and for the eighth year has accounted for over 50% of all such piping. In 1981, 84.2% of the total of 24,723 miles of gas mains and services installed was fabricated of plastic. Nearly all of the 20,831 miles of plastic installed is polyethylene, according to PIPELINE & GAS JOURNAL's 16th annual gas distribution piping survey.

Responses to P&GJ's survey indicate that 109,988,960 ft of plastic pipe will be used for new and replacement mains and services during 1981. That's the second best year ever for plastic pipe (over 115 million ft were installed in 1980).

An equally good year is projected for 1982, when 20,728 miles of plastic piping are expected to be installed, approximately 82.4% of the total 25,167 miles of new and replacement mains and services to be placed in service during 1982.

Total plastic pipe installed by gas distribution utilities in the U.S. has now reached 196,630 miles, and some 933 gas distribution utilities report having used some type of plastic pipe currently or in the past. There are 70 major users – utilities having more than 750,000 ft of plastic pipe in their systems.

Overall, plastic pipe now represents 16.4% of all piping installed for utility delivery of gas.

Plastic pipe usage, expressed as a percentage of all gas distribution piping installed each year, continues to increase. The record is:

- 1966 . . . 12.0% was plastic
- 1967 . . . 13.5% was plastic
- 1968 . . . 16.5% was plastic
- 1969 . . . 19.0% was plastic
- 1970 . . . 21.2% was plastic
- 1971 . . . 24.9% was plastic
- 1972 . . . 31.3% was plastic
- 1973 . . . 42.2% was plastic
- 1974 . . . 50.6% was plastic
- 1975 . . . 55.8% was plastic
- 1976 . . . 54.5% was plastic
- 1977 . . . 72.2% was plastic
- 1978 . . . 66.9% was plastic
- 1979 . . . 69.8% was plastic
- 1980 . . . 78.0% was plastic
- 1981 . . . 84.2% was plastic
- 1982 . . . 82.4% was projected to be plastic

Usage Trends

Plastic pipe for new and replacement mains represented 48.7% of the total amount of plastic pipe installed during 1981, while 51.2% was used for new and replacement services. The remaining 0.1% found its way into other applications, such as connections for gas grills and for non-fuel-gas applications.

Of the gas companies reporting use of plastic materials, 96% are using plastic pipe for both new and replacement mains, and 95% use plastic pipe for new and replacement gas services.

Dominating the market is polyethylene, in grades 2306, 3306, 3406, and 3408 in use by 98.95% of all companies that install plastic pipe today. Only 1.4% use PVC in any size, according to P&GJ's survey, and only 0.7% use ERF pipe. No other types were mentioned in survey responses.

Size of Plastic Pipe Installed (% of Total) by Gas Distribution Utilities

Size (Inches)	% Total 1979	% Total 1980	% Total 1981	% Total 1982
1 and under	55.1	50.3	50.5	49.3
1¼ to 2	36.3	40.1	38.4	38.6
3	3.6	2.9	3.6	3.8
4	4.2	5.6	5.4	6.1
6 and over	0.8	1.1	2.1	2.2

1981 Gas Distribution Utility Usage of Plastic Pipe

Type of Installation	% of Total
New Mains	23.3
Replacement Mains	25.4
New Services	25.8
Replacement Services	25.4
Other Applications	0.1

Of the grand totals of piping installed, as compiled from survey responses, 49.1% of the plastic pipe in use is 1-in. and under in size. Another 41.9% is in the 1¼-in.-to-2-in. range, 4.9% is 3-in., 3.6% is 4-in. and 0.5% is larger than 4-in.

Plastic Use Trend Increases

P&GJ's survey in 1981 asked plastic piping users to comment on their use of the material and to note how it has changed procedures and equipment requirements for construction, maintenance, and repair. The comments included:

"We have used plastic for so long we have not had to make any recent changes except to keep up with the state of the art."

"We have used plastic since 1973 and our crews have adapted all new tools and procedures successfully."

"We now use plastic pipe exclusively for pressures under 90 psig; no problems."

"Less welding and pipe wrapping equipment needed now that we are predominantly plastic; less equipment is needed and cathodic protection requirements are less."

"We are purchasing fusion equipment as we plan to use plastic for at least 10% of all main installations."

"Have found there is a rapid transition with respect to material, equipment, and training."

"Plastic has been a boon – much simpler to use and corrosion problems do not exist."

"Joining of the pipe constitutes the major change; we have had to buy additional heat fusion tools and power generators, and train personnel in the new methods of joining pipe."

"We have had to equip the majority of our street repair crews with new tools and train them in the new techniques as a result of our using more and more plastic pipe."

"We have been using plastic since 1970, so no new changes have occurred."

"We switched to plastic several years ago; we found it reduces installation effort by approximately 20%." **P&GJ**

Profitable U.S. Operations Increase Net Income

by Cindy Mays, *Editor, ENERGY WEEK*

Earnings for the third quarter were slightly higher on the whole as oil companies with major U.S. petroleum operations experienced substantial increases in net income. Higher prices for crude oil and increased production helped Marathon Oil earn 52 percent more, while Shell Oil rose 33 percent and Atlantic Richfield went up 11 percent.

Companies with a larger stake in foreign refining and marketing operations, however, suffered losses. Because local currency price increases failed to recover the higher costs caused by a stronger U.S. dollar during most of the quarter, Mobil dropped 30 percent, Exxon, 21 percent, Standard Oil of California, 16 percent and Texaco, eight percent. Overall, U.S. petroleum earnings gained four percent while foreign petroleum earnings fell 36 percent.

The 69 oil companies who participated in our survey show a 13.1 percent increase in net income from last year. Profit margin for the group fell from 6.2 percent to 5.3 percent.

Higher Alaskan crude oil prices and improved refining and marketing operations resulted in an eight percent increase for Standard Oil Co. (Ohio).

Standard Oil Co. (Indiana) posted net earnings of $608.3 million compared to $448.9 million last year due to higher exploration, production and chemicals earnings.

Better profit margins in refining, marketing and chemicals, plus a threefold increase in North Sea oil production explained Gulf Oil's $316 million earnings, a 30 percent increase over last year.

Tenneco blamed higher interest

THIRD QUARTER NATURAL GAS COMPANIES FINANCIAL REPORTS

	Three months ending September 30**						Twelve months ending September 30**						Profit‡ Margin	
	Revenues ($000)			Earnings* ($000)			Revenues ($000)			Earnings* ($000)				
Company	1981	1980	% Chg.	1981	1980	% Chg.	1981	1980	% Chg.	1981	1980	% Chg.	1981	1980
American Natural Resources	529,022	379,045	+ 39.6	487	(15,349)		2,821,827	2,269,818	+ 24.3	151,253	116,304	+ 30.0	5.4	5.1
Arkansas Louisiana Gas	254,726	205,914	+ 23.7	12,118	8,840	+ 37.1	1,137,029	930,883	+ 22.2	85,464	75,900	+ 12.6	7.5	8.2
Columbia Gas	713,683	573,331	+ 24.5	(148)	(3,583)		4,132,313	3,557,148	+ 16.2	176,569	157,500	+ 12.1	4.3	4.4
El Paso Companies	1,061,000	878,000	+ 20.8	39,172	8,732	+348.6	3,069,000[1]	2,615,000[1]	+ 17.4	107,848[1]	49,611[1]	+117.4	3.5	1.9
Houston Natural Gas[2]	800,617	606,450	+ 32.0	63,149	47,718	+ 32.3	2,906,310	2,357,871	+ 23.3	238,248	196,190	+ 21.4	8.2	8.3
Mountain Fuel Supply							457,287	391,048	+ 16.9	28,388	31,491	- 9.9	6.2	8.1
Northwest Energy	224,780	212,035	+ 6.0	10,778	6,462	+ 66.8	1,336,757	1,312,211	+ 1.9	63,993	49,995	+ 28.0	4.8	3.8
Pacific Lighting	801,550	668,617	+ 19.9	28,536	21,988	+ 29.8	3,227,856	2,760,221	+ 16.9	142,251	86,093	+ 65.2	4.4	3.1
Panhandle Eastern	746,133	546,623	+ 36.5	56,180	43,543	+ 29.0	3,187,659	2,303,799	+ 38.4	253,529	164,727	+ 53.9	8.0	7.2
Pioneer Corp.	310,952	234,666	+ 32.5	27,199	20,774	+ 31.9	1,139,182	880,184	+ 29.4	108,960	83,610	+ 30.3	9.6	9.5
Southern Natural Resources	598,891	375,040	+ 59.7	36,630	36,304	+ 0.9	2,369,695	1,760,992	+ 34.6	157,129	130,019	+ 20.9	6.6	7.4
Southern Union Co.	220,122	205,505	+ 7.1	69	2,147	- 96.8	1,054,522	880,291	+ 19.8	37,913	37,238	+ 7.2	3.6	4.2
Texas Eastern Corp.	1,110,982	972,934	+ 14.2	45,521	44,118	+ 3.2	4,439,326	3,985,522	+ 11.4	226,856	207,076	+ 9.6	5.1	5.2
Texas Gas Transmission	610,884	504,564	+ 21.1	25,880	18,814	+ 37.6	2,513,520	2,099,425	+ 19.7	115,863	88,741	+ 30.6	4.6	4.2
Texas Oil & Gas[3]	461,121	324,293	+ 42.2	53,115	39,824	+ 33.4	1,610,523	1,190,790	+ 35.2	191,924	141,116	+ 36.0	11.9	11.9
TransCanada Pipelines	742,164	681,281	+ 8.9	31,522	23,137	+ 36.2	3,485,765	2,995,320	+ 16.4	109,320	91,420	+ 19.6	3.1	3.1
Transco Companies	818,769	620,603	+ 31.9	28,587	25,191	+ 13.5	3,435,554	2,277,108	+ 50.9	122,786	103,161	+ 19.0	3.6	4.5
Union Gas Ltd.	149,484	115,401	+ 29.5	(4,580)	(3,723)		901,079	718,009	+ 25.5	22,504	16,651	+ 35.2	2.5	2.3
United Energy Resources	1,392,461	1,057,726	+ 31.6	49,632	38,322	+ 29.5	5,047,770	3,979,697	+ 26.8	207,278	145,500	+ 42.5	4.1	3.7
TOTALS	11,547,341	9,162,028	+ 26.0	504,047	363,259	+ 38.8	48,272,974	39,265,337	+ 22.9	2,548,076	1,972,343	+ 29.2	5.3	5.0

**Excluding non-recurring items. *Earnings available to common stock. ‡Profit Margin=Earnings* ÷ Revenues. [1]Nine months. [2]Ends July 31. [3]Ends Aug. 31. ( )Loss.

rates and "the recessionary aspects of the economy" for their four percent decrease. Although energy earnings were down in the processing and marketing areas, they were offset by strong results in exploration and production.

Pennzoil's earnings from oil, gas and sulphur production were more than offset by severly depressed metals prices and continuation of lower than normal refined petroleum products margins.

Once again, non-utility oil and gas activities led gains in net income for large gas companies. Earnings for the survey group rose 38.8 percent.

A combination of expanded processing capacity and increased demand accounted for a 35 percent increase for Texas Oil & Gas.

Each of United Energy Resources' five principal subsidiaries contributed to the company's 77 percent gain, while lower utility operations earnings caused Mountain Fuel Supply to suffer a 10 percent loss.

El Paso Co. net income rose to $39.1 million from $25.4 million as a result of increased profitability of gas and oil exploration and production activities from natural gas operations.

Northwest Energy Co.'s net income rose 63 percent to $12.4 million. The increase was attributed to additional investment tax credits and allowance for funds used during construction of the 351-mile expansion of Northwest Pipeline's transmission system.

THIRD QUARTER OIL COMPANY FINANCIAL REPORTS

	Three months ending September 30**						Nine months ending September 30**						Profit Margin‡	
	Revenues ($000)			Earnings* ($000)			Revenues ($000)			Earnings* ($000)				
Company	1981	1980	% Chg.	1981	1980	% Chg.	1981	1980	% Chg.	1981	1980	% Chg.	1981	1980
Alaska Interstate	88,375	57,428	+ 53.9	8,525	13,985	- 39.0	259,983	175,675	+ 48.0	32,755	42,886	- 23.6	12.6	24.4
American Petrofina	610,747	467,493	+ 30.6	21,650	28,431	- 23.9	1,990,945	1,485,014	+ 34.1	57,151	84,964	- 32.7	2.9	5.7
American Quasar	14,874	11,011	+ 35.1	721	1,139	- 36.7	42,993	32,849	+ 30.9	2,322	4,776	- 51.4	5.4	14.5
Argo Petroleum	4,374	3,558	+ 22.9	361	716	- 49.6	12,832	9,770	+ 31.3	1,594	1,553	+ 2.6	12.4	15.9
Argonaut Energy	1,728	903	+ 91.4	(234)	61		3,504[1]	1,601[1]	+118.9	(315)[1]	71[1]			4.4
Ashland Oil	2,592,876	2,213,857	+ 17.1	43,557	29,486	+ 47.7	7,475,881	6,375,947	+ 17.3	52,572	112,516	- 53.3	.7	1.8
Asamera	119,239	89,587	+ 33.1	2,542	1,487	+ 70.9	224,378[1]	169,655[1]	+ 32.3	3,088[1]	4,406[1]	- 29.9	1.4	2.6
Atlantic Richfield	6,967,639	5,636,821	+ 23.6	433,532	389,711	+ 11.2	21,067,993	16,765,447	+ 25.7	1,201,472	1,253,144	- 4.1	5.7	7.5
Beard Oil	9,013	5,227	+ 72.4	1,356	1,040	+ 30.4	25,280	15,884	+ 59.2	3,851	3,449	+ 11.7	15.2	21.7
Belco Petroleum	77,454	68,280	+ 13.4	24,088	15,927	+ 51.2	234,765	213,862	+ 9.8	71,984	47,747	+ 50.8	30.7	22.3
Burton/Hawks	1,188	685	+ 73.4	514	24	+2042.0	2,740	1,839	+ 49.0	606	26	+2231.0	22.1	1.4
Callon Petroleum[2]	3,136	2,724	+ 15.1	144	717	- 79.9	7,805	6,590	+ 18.4	1,129	1,354	- 16.6	14.5	20.5
Cities Service	2,131,800	1,635,400	+ 30.4	77,600	92,600	- 16.2	6,615,900	5,621,700	+ 17.7	225,800	369,700	- 38.9	3.4	6.6
Consolidated Oil & Gas	12,214	8,503	+ 43.6	2,015	1,172	+ 71.9	36,564	24,961	+ 46.5	5,708	882	+547.2	15.6	3.5
Crown Central	316,196	317,705	- 0.5	(5,189)	398		1,074,809	953,150	+ 12.8	(11,503)	15,279			1.6
Diamond Shamrock	820,569	773,955	+ 6.0	51,815	49,626	+ 4.4	2,503,667	2,296,690	+ 9.0	163,476	158,669	+ 3.0	6.5	6.9
Dorchester Gas[2]	230,842	154,842	+ 49.1	7,704	9,704	- 20.6	712,033[3]	608,760[3]	+ 17.0	31,287[3]	34,919[3]	- 10.4	4.4	5.7
Dyco Petroleum	12,647	8,541	+ 48.1	3,819	2,059	+ 85.5	35,423	22,254	+ 59.2	10,368	5,588	+ 85.5	29.3	25.1
Equity Oil	6,318	4,993	+ 26.5	1,393	1,248	+ 11.6	18,759	11,962	+ 56.8	4,280	3,037	+ 40.9	22.8	25.4
Exeter Oil	1,158	1,137	+ 1.8	244	326	- 25.2	3,912	3,026	+ 29.3	994	881	+ 12.9	25.4	29.1
Exxon	27,614,000	26,745,000	+ 3.2	1,075,000	1,355,000	- 20.7	85,406,000	80,622,000	+ 5.9	4,500,000	4,310,000	+ 4.4	5.3	5.3
Felmont	20,046	15,335	+ 30.7	3,762	3,764	--	56,271	42,223	+ 33.3	12,395	11,714	+ 5.8	22.0	27.7
Forest	37,818	22,414	+ 68.7	369	1,504	- 75.5	103,812	65,741	+ 57.9	3,597	4,165	- 13.6	3.5	6.3
Freeport-McMoRan Inc.	202,834	191,509	+ 5.9	44,332	49,820	- 11.0	635,650	511,230	+ 24.3	133,307	135,485	- 1.6	21.0	26.5
Getty	3,267,550	2,558,560	+ 27.7	204,931	191,555	+ 7.0	9,778,720	7,470,557	+ 30.9	639,636	659,990	- 3.1	6.5	8.8
Gulf Energy & Development	14,299	12,000	+ 19.2	1,777	1,342	+ 32.4	42,480	31,801	+ 33.6	5,067	4,739	+ 6.9	11.9	14.9
Gulf Oil Corp.	7,430,000	6,622,000	+ 12.2	316,000	244,000	+ 29.5	22,504,000	21,169,000	+ 6.3	930,000	1,103,000	- 15.7	4.1	5.2
Hadson	8,547	3,095	+176.2	4,108	1,115	+268.3	15,358	8,492	+ 80.8	6,277	2,687	+133.6	40.9	31.6
Holly Corp.[4]	99,515	97,314	+ 2.3	(1,495)	1,232		289,644	310,601	- 6.7	274	7,506	- 96.3	0.1	2.4
Inexco Oil	61,525	39,689	+ 55.0	7,533	6,037	+ 24.8	176,117	107,386	+ 64.0	22,325	17,386	+ 28.4	12.7	16.2
KRM Petroleum	1,377	1,047	+ 31.5	380	137	+177.4	4,111	3,449	+ 19.2	878	712	+ 23.3	21.4	20.6
Louisiana L&E	260,805	247,281	+ 5.5	34,479	37,510	- 8.1	881,748	770,671	+ 14.4	126,696	131,935	- 3.9	14.4	17.1
Mapco Inc.	512,398	407,266	+ 25.8	11,332	21,830	- 48.1	1,597,792	1,236,876	+ 29.2	65,776	93,291	- 29.5	4.1	7.5
Marathon Oil	2,619,658	2,028,189	+ 29.2	146,628	76,347	+ 92.1	7,177,508	6,333,450	+ 13.3	303,005	323,743	- 6.4	4.2	5.1
Marion Corp.	119,960	95,175	+ 26.0	81	6,149	- 98.7	348,422	332,280	+ 4.9	3,749	15,102	- 75.2	1.1	4.5
Mesa Petroleum	103,810	83,737	+ 24.0	23,995	16,692	+ 43.8	308,346	295,616	+ 8.0	78,259	61,257	+ 27.8	25.4	21.4
MGF	27,610	19,061	+ 44.9	2,191	1,996	+ 9.8	82,367	53,200	+ 54.8	7,239	4,703	+ 53.9	8.8	8.8
Mobil Corp.	16,845,000	15,663,000	+ 7.5	506,000	721,000	- 29.8	50,549,000	46,338,000	+ 9.1	1,846,000	2,255,000	- 18.1	3.7	4.9
Moran Energy	24,412	17,236	+ 47.4	4,812	3,480	+ 38.2	74,371	47,155	+ 57.7	14,727	8,310	+ 77.2	19.8	17.6
Murphy Oil	531,867	455,615	+ 16.7	41,123	40,914	+ 0.5	1,858,694	1,479,698	+ 25.6	124,548	104,937	+ 18.7	6.7	7.1
Natomas	404,000	325,700	+ 24.0	67,900	58,900	+ 15.3	1,140,000	952,500	+ 19.7	183,700	164,300	+ 11.8	16.1	17.2
Noble Affiliates	101,847	70,466	+ 44.5	21,918	8,558	+156.1	282,752	205,315	+ 37.7	58,309	34,107	+ 71.0	20.6	16.6
Occidental Petroleum	3,730,700	2,951,300	+ 26.4	115,800	133,700	- 13.4	10,238,200	9,296,500	+ 10.1	456,400	572,700	- 20.3	4.5	6.2
Oxoco	6,852	3,052	+124.5	1,136	538	+111.2	15,617	8,494	+ 83.9	1,924	893	+115.5	12.3	10.5
Patrick Petroleum[5]	23,912	12,222	+ 95.6	1,866	226	+725.2								
Pennzoil Co.	668,666	579,692	+ 15.3	46,445	68,649	- 32.3	2,028,769	1,823,593	+ 11.3	163,549	227,692	- 28.2	8.1	12.5
Petroleum Development	2,843	2,602	+ 9.2	(149)	72		9,306	10,966	- 15.1	464	912	- 49.1	5.0	8.3
Phillips Petroleum	3,895,148	3,224,120	+ 20.8	192,287	283,378	- 32.1	12,196,572	9,838,461	+ 24.0	692,838	782,641	- 11.4	5.7	8.0
Prairie Producing Co.	8,378	5,890	+ 42.0	1,111	882	+ 26.0	22,935	15,417	+ 49.0	2,720	2,917	- 6.7	11.8	18.3
Quaker State	251,660	214,676	+ 17.2	9,613	5,937	+ 61.9	689,736	610,427	+ 13.0	20,616	20,312	+ 1.5	3.0	3.3
Sabine Corp.	40,486	31,046	+ 30.4	6,679	6,281	+ 6.3	125,921	89,374	+ 40.9	22,714	18,134	+ 25.3	18.0	20.3
Shell Oil	5,578,000	5,135,000	+ 8.6	471,000	353,000	+ 33.4	16,545,000	14,828,000	+ 11.6	1,242,000	1,133,000	+ 9.6	7.5	7.6
Southland Royalty	100,758	75,204	+ 34.0	6,911	5,385	+ 28.3	301,085	204,934	+ 46.9	27,321	13,351	+104.6	9.1	6.5
Southwestern Energy	9,408	8,318	+ 13.1	1,717	1,291	+ 33.0	41,441	35,247	+ 17.6	9,569	7,455	+ 28.4	23.1	21.2
Standard California	11,458,000	10,509,000	+ 8.3	527,000	624,000	- 15.5	34,425,000	31,605,000	+ 8.9	1,809,000	1,786,000	+ 1.3	5.3	5.7
Standard Indiana	7,957,000	6,488,000	+ 22.6	608,300	448,900	+ 35.5	23,949,000	20,134,000	+ 18.9	1,537,800	1,513,100	+ 1.6	6.4	7.5
Standard Ohio	3,010,800	2,542,700	+ 18.4	470,000	433,400	+ 8.4	9,038,000	8,042,000	+ 12.4	1,469,100	1,335,400	+ 10.0	16.3	16.6
Sun Co.	3,700,000	3,000,000	+ 23.3	210,000	195,000	+ 7.7	11,600,000	9,100,000	+ 27.5	628,000	693,000	- 9.4	5.4	7.6
Superior Oil	499,785	376,070	+ 32.9	80,811	78,054	+ 3.5	1,496,872	1,056,975	+ 41.6	288,066	237,255	+ 21.4	19.2	22.4
Supron Energy	20,600	15,040	+ 37.0	5,300	4,362	+ 21.5	58,073	46,287	+ 25.4	15,421	13,687	+ 12.7	26.5	29.5
Tenneco	3,604,000	3,102,000	+ 16.2	141,000	146,000	- 3.4	11,249,000	9,684,000	+ 16.2	507,000	490,000	+ 3.5	4.5	5.1
Texaco Inc.	14,472,800	12,641,400	+ 14.5	589,700	636,400	- 7.3	44,731,900	38,427,600	+ 16.4	1,803,400	1,739,900	+ 3.7	4.0	4.5
Tosco Corp.	900,655	574,173	+ 56.9	19,100	9,321	+104.9	2,529,999	1,706,599	+ 48.2	(7,516)	55,933			3.3
Transcontinental Oil	24,968	19,615	+ 27.3	2,712	785	+245.5	71,157	56,383	+ 26.2	7,700	954	+707.1	10.8	1.7
Union California	2,871,900	2,630,100	+ 9.2	193,000	122,000	+ 58.2	8,314,200	7,757,100	+ 7.2	555,400	469,800	+ 18.2	6.7	6.1
Universal Resources[5]	16,837	8,584	+ 96.1	3,600	2,024	+ 77.8	46,425	27,497	+ 68.8	9,922	4,869	+103.8	21.3	17.7
Westcoast Petroleum	8,869	8,069	+ 9.9	1,381	1,821	- 24.2	28,434	25,351	+ 12.2	4,413	6,334	- 30.3	15.5	25.0
Wiser Oil	14,339	13,892	+ 3.2	3,250	3,174	+ 2.4	47,779	43,953	+ 8.7	13,134	11,525	+ 14.0	27.5	26.2
Woods Petroleum	16,638	14,072	+ 18.2	4,523	4,043	+ 11.9	49,069	38,920	+ 26.1	13,264	10,419	+ 27.3	27.0	26.8
TOTAL	137,225,267	121,369,176	+ 13.1	6,907,406	7,057,362	- 2.1	415,512,819	367,686,955	+ 13.0	22,218,602	22,748,099	- 2.3	5.3	6.2

**Excluding non-recurring items. *Earnings available to common. ‡Profit Margin=Earnings ÷ Revenues. [1]Six months. [2]Ends August 31. [3]Twelve months. [4]Ends April 30. [5]Ends July 31. ()Loss.

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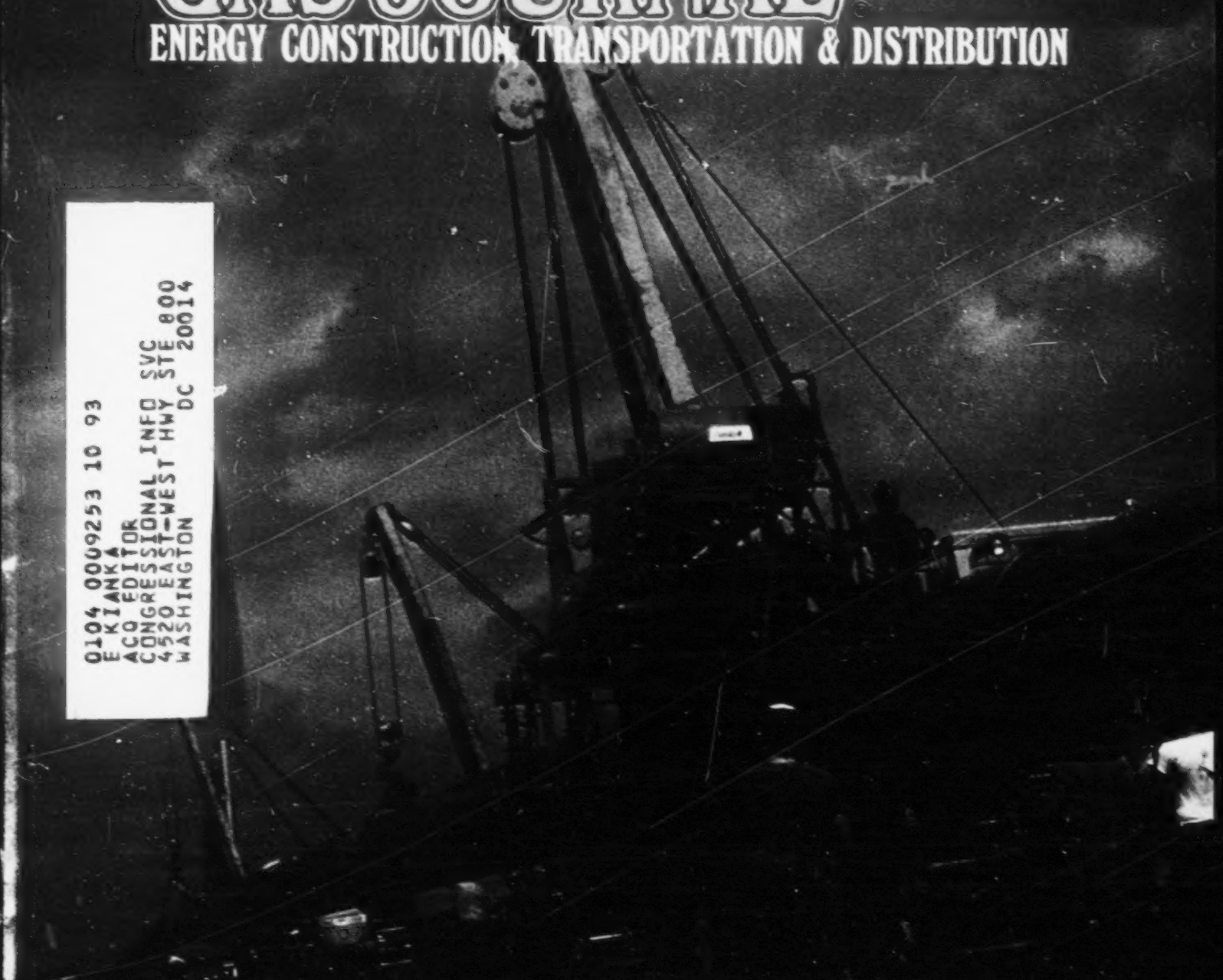

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Several major pipeline projects are expected to be built during 1982, including the first major carbon dioxide pipeline from Colorado to Texas, and contractors will continue their battles with costs and productivity; these are highlights of P&GJ's exclusive 12th annual Contractor Roundtable.

Worldwide Pipeline Work Will Continue To Be Good 24

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Over 48,000 Miles Planned For U.S. and Canada Construction 28

1982 will be another good year for pipeline construction activity with over 12,000 miles to be built in the U.S. and over 2000 miles in Canada; total planned, proposed, and underway mileage in U.S. is over 35,000 miles; in Canada, over 13,000 miles.

1982 Will Be Big Year In Canada For Big-Inch Pipelining Work 36

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Mobile Telephone/Radio Trailer Provides Emergency Communication 65

Oklahoma Natural Gas Co. uses special trailer-mounted communications center, complete with portable mast and mobile generator, to provide full communications services in event of emergencies such as tornadoes, floods, fires, civil defense, and other catastrophes.

COVER
Coating crews wrap 42-in. pipe for burial on the Northern Border Pipe Line in Montana as part of 1981's biggest U.S. pipeline project.

– photo courtesy Northern Border Pipe Line Co.

Construction Forecast

Over 48,000 Miles Planned For U.S. And Canada

by **Dean Hale**, *Editor* and **Jim Watts**, *Assistant Editor*

Another good year in pipeline construction activity is expected in the United States during 1982, reflecting continuing emphasis on development of energy supplies and insuring that newly-found oil and gas can be transported to market. Confident that the nation's economy will return to a healthy state after a period of adjustment, oil and gas energy producers and pipeline transporters are making plans to continue adding significant new facilities and to extend the national energy distribution system to previously untouched or lightly served areas.

As of Jan. 1, 1982, the number of pipeline projects planned, proposed, or underway reached a total of 35,167 miles. For 1982, some 12,041 miles of cross-country pipelines are expected to be installed, according to PIPELINE & GAS JOURNAL's annual U.S. Pipeline Construction Survey.

Total for the U.S. and Canada for all planned, proposed, or underway projects is a record 48,221 miles. Canada expects to have an excellent year in 1982 – for the second year in a row -- with some 2050 miles of mainline and gathering lines expected to be installed. Most of that will be large diameter gas pipeline *(see related article this issue)*.

The 11,200 miles of pipelines projected for 1982 completion is slightly less than 1981's projection, but remains an indication of the increased activity needed to meet present and future needs of the cross-country oil, products, and natural gas pipeline companies. The accompanying table provides a breakdown of all planned lines and projected completions.

Gas Pipelines

Completion of the Western Leg Construction by Pacific Gas Transmission (it went into operation in October) and much of the Eastern Leg of the Alaskan Highway Gas Pipeline Project highlighted 1981 activity. Still to be completed are some 270 miles (sections 3, 4, and 5) of Northern Border Pipeline in North Dakota – work scheduled for late spring and early summer. North Dakota is also the site of the proposed North Dakota Gathering System, 133 miles of 12 and 16-in. that would tie-in with Northern Border; United Gas Pipe Line is lead company in a group that includes Northern Natural Gas and Natural Gas Pipeline Co. of America.

Trailblazer Pipeline System is moving ahead, with 439 miles of 36-in. expected to be installed during 1982; another 358 miles of 30-in. will be built later. Another system designed to take gas from the Rocky Mountain region to the Midwest, Michigan Wisconsin Pipe Line's Pathfinder project, has been expanded and now calls for a $231 million, 634-mile 20 and 24-in. system.

The Rocky Mountain Pipeline Project (610 miles of 36-in. from Sage, Wyo., through Utah and Nevada to California) has been okayed in a federal environmental impact study. Gas would be delivered to PG&E, Southern California Gas Co., and Pacific Lighting Service Co. Line would be owned by Pacific Gas Transmission, El Paso Natural Gas, Pacific Interstate Transmission Co., and Northwest Pipeline Co. Another Rocky Mountain-oriented gas project is the Battery Limits project, involving 525 miles of 16 and 18-in. line.

In the southwest, Red River Pipe Line Co. plans to build in 1982 a 360-mile, 24-in. system from the Texas Panhandle to Southwest Texas. Ozark Pipeline, after clearing all sorts of regulatory hurdles, is underway in Oklahoma and Arkansas with 285 miles of 20-in.

In the northeastern area of the U.S., three major pipeline proposals, each designed to deliver an additional 300 million cu ft per day, are vying for that market. One, the Boundary Gas Project (owned by 14 northeastern gas utilities), would involve 261 miles of pipeline loops in Pennsylvania, New York, and the New England states by Tennessee Gas Pipeline Co. Another, New England States Pipeline Co., involves 350 miles of 36-in. line. A third project by Transcontinental Gas Pipeline Corp. would involve building 110 miles of line in northwest Pennsylvania, including a crossing of Lake Erie.

Florida Gas Transmission's plans to add 376 miles of loops on its system, to permit conversion of 890 miles of older line to products service, still awaits final approval from FERC.

Carbon Dioxide Pipelines

Shell Oil is getting underway on its planned 503-mile, 30-in. Cortez Pipeline project to bring CO_2 from natural occurring fields near Cortez, Colo., to the Denver Unit of the Wasson Field in West Texas. Pipe is being coated and construction contracts are expected to be awarded in early 1982. Amoco

1982 PIPELINE OUTLOOK

Miles Planned or Underway

Type of Line	U.S.	Canada
Natural Gas	14,628	11,213
CO_2 (Carbon Dioxide)	1,920	—
Crude Oil	3,561	924
Products	4,812	417
Slurry	10,246	500
TOTALS	35,167	13,054
GRAND TOTAL, U.S. AND CANADA	48,221	

Projected Completion, Miles

Type of Line	U.S.	Canada
Natural Gas	4314	
CO_2	600	
Crude Oil	424	2050
Products	926	
Slurry	—	
Oil/Gas Gathering	3727	
TOTALS	9991	2050
GRAND TOTAL	12,041	

Production is working on a 300-mile, 20-in. line from Bravo Dome to the Permian Basin, which might take shape in 1982, and ARCO Pipeline's Sheep Mountain Pipeline Project could also get under way in 1982.

Crude Oil Lines

Biggest news of late 1981 is that Frontier Pipeline, a subsidiary of Amoco Pipeline Co., is planning a 300-mile, 20-in. crude oil line in Wyoming that may be constructed in 1982. Getty Oil has a 70-mile, 16-in. project in California, and the U.S. Navy has underway 135 miles of 3 thru 20-in. at the Naval Reserve field in California.

The really big project – Northern Tier's 1491 mile, 40 and 42-in. line from near Seattle to Minnesota, has all of its permits but one – the vital one permitting the line to connect via a deepwater terminal in Puget Sound to tankers from Alaska and other points. Northern Tier is optimistic it will resolve the problem in 1982. If so, work could begin in late 1982 or early 1983.

Products Pipe Lines

Colonial Pipe Line reportedly is planning 240 miles of 16-in. from Augusta, Ga. to Charleston, S. C., with a branch to Savannah, plus 190 miles of 36-in. loop on its line from Baltimore to Linden, N.J. Enterprise Products Co. plans 145 miles of 8-in. LPG line in Louisiana and Mississippi; MAPCO is planning some 376 miles of 3, 6, and 8-in. extensions to its system; Provident Energy plans a 30-mile, 12-in. line near Phoenix, Ariz., and Texas Eastman Co. plans 130 miles of 8-in. from Longview, Tex. to Shreveport, La.

Slurry Pipelines

Some work on the Energy Transportation System, Inc. 1440-mile, 38-in. system may get underway in 1982. Acquisition of ROW is well underway and design plans are reportedly ahead of schedule. What happens to the other 8800 miles may well still depend on what a reluctant Congress does about the right of *eminent domain* for coal slurry lines. President Reagan has officially declined to support the *eminent domain* cause, stating that it should be up to the states to provide access.

Another smaller but very interesting slurry pipeline project may get underway in Utah and Wyoming in 1982. Chevron Chemical Co. reportedly is planning an 80-mile slurry line between Vernal, Utah, and Rock Springs, Wyo. to transport phosphate for use in a petrochemical plant. **P&GJ**

Planned And Proposed Pipeline Projects

U.S.—Natural Gas Pipelines

COMPANY	MILES	SIZE (IN.)	FROM	TO	COST ($MILLIONS)	STATUS	CONTRACTORS/NOTES
Adobe Gas	80	N/A	Toole, Liberty & Hill cos., Mont.		—	Planned	
Algonquin Gas Transmission	21.1	30	Lambertville, N.J., area		—	Planned	
Battery Limits Project	525	16 & 18	Western N. Dakota	Duluth, Minn.	—	Planned	
Colorado Interstate Gas	202	30					
	50	26	Wyo., Colo., Kan., Okla.		145	Planned	
	48	20					
	110	30					
	70	16	Cheyenne, Wyo.	Latigo Junction, Colo.	85.7	Planned	
	1.7	12					
Columbia Gas Transmission Co.	25	8	Clay, Owsley, Lee, & Estill cos., Ky.		—	Planned	
	347	2-26	Ohio, N.Y., Pa., Md., Ky		—	Planned	
	103.7	24	Pa.		56	Planned	
	7.3	16	Orange County, N.Y.		2.9	Planned	
	54.2	4, 6, 8, 12	Pa. & N.Y.		10.5	Planned	
Columbia Gulf Transmission	12.9	10-16	Ship Shoal area, offshore La.		—	Planned	
	21	6-10	Offshore La.		9	Planned	
	11	6	Eugene Island area, offshore La.		—	Planned	
	5	12 & 16	Offshore La.		—	Planned	
	127.7	10, 12, 30	Eugene Island, West Cameron areas, offshore La.		—	Planned Planned	w/Natural Gas P/L of America
	9.71	10	Vermilion area, offshore La.		4.3	Planned	
	10.1	22	Uinta County, Utah		5	Planned	
	3.8	20	South Pass area, offshore La.		4.8	Planned	Southern Natural, 20%
Consolidated Gas Supply Corp.	7.5	20	High Island area, offshore Tex.		8.1	Planned	
	63	30	Canton, Ohio	Ohio River	—	Planned	
Corpus Christi Oil & Gas	250	24	North Padre Island	Sabine Pass	—	Planned	
Eastern Shore Natural Gas	5	10	Dover, Del.	Harrington, Del.	1.3	Under Construction	Veshall Bros. Welding
El Paso Natural Gas Co.	119.8	6, 20, 24	Eddy County, N.M.		—	Planned	
	9.9	12	Ocotillo Pipeline, Ariz.	Maricopa Co., Ariz.	2.7	Planned	
Florida Gas Transmission	375.8	4, 20, 26, 30	Zachary, La.	Ft. Lauderdale, Fla.	—	Planned	Loops
	42.2	4, 6, 12, 14	Lines in Florida		10	Planned	
	4.7	26	Lines in Louisiana		6	Planned	
	1.0	6	Lines in Mississippi		0.25	Planned	
Galaxie Industries	22	10	Lamar & Fayette cos., Ala.		—	Planned	
Great Lakes Transmission	30.1	36	Minnesota		18.7	Planned	
	365	20	Mercer Co., N.D.	Thief River Falls, Minn.	—	Planned	From Great Plains Gasification Plant
	125	36	Minn., Mich., Wisc.		—	Planned	
	30.8	36	Minn., Wisc.		25.9	Planned	
Gulf States Utilities	110	½-8	East Baton Rouge Parish, La.		1.5	Planned	
High Island Offshore System	66	36	Offshore Tex.		101	Planned	
Houston Pipe Line Co.	10	4 & 12	Harris County, Tex.		12	Planned	
	5	24	Harris County, Tex.		3	Planned	
Kansas-Nebraska Natural Gas	22.3	16	Lexington, Neb.	Riverdale, Neb.	2.5	Planned	
	18.1	16	Cairo, Ill.	Grand Isle, Neb.	2.1	Planned	
	190	4 & 6	Colo., Mont., Wyo.		8	Planned	
Louisiana Intrastate Gas Corp.	55.3	16	South Pass area, offshore La.	Barataria Bay, La.	—	Planned	
Louisiana Gas Pipeline Corp.	25.8	36	Bayou Sale, La.	Napoleonville, La.	36.8	Planned	
Michigan Consolidated Gas	77	N/A	Taggart Storage Field, Mich.		40	Planned	
Michigan Wisconsin Pipe Line co.	634	24	Fremont Co., Wyo.	Greenburg, Kan.	231	Planned	Pathfinder Pipeline
	63.2	12, 24, 30	Offshore La.	Onshore La.	73.9	Planned	
	3.5	10	Offshore Tex.		4.9	Planned	
	49	12 & 20	Tex., Okla., Kan.		16.5	Planned	
	81.4	36 & 42	La., Ind., Ky., Miss.		52.2	Planned	
	12.1	42	Ind., Mich.		15.9	Planned	
	66	36	Offshore Tex.		101	Planned	
	15.3	30	Lowrey, La.		—	Planned	
	39	20	Offshore La.	Cameron Parish	80.4	Planned	
	1.8	8	West Cameron area, Offshore La.		4.1	Planned	
	81	16	Kan., Okla., Tex.		29.5	Planned	
	24	20					
	1.8	16	Kiowa Co., Kan.		1.8	Planned	Southern Natural, 20%

U.S.—Natural Gas Pipelines

COMPANY	MILES	SIZES (IN.)	FROM	TO	COST ($MILLIONS)	STATUS	CONTRACTORS/NOTES
Natural Gas Pipeline Co. of America	14.2	8	High Island area, Offshore Tex.		—	Planned	
	222	4 & 10	Colo. & Neb.		36	Planned	
	16	6-12	Offshore Tex.		13.5	Planned	
	4.9	10	West Cameron area, offshore La.		3.9	Planned	FERC OK 7-81
	74.7	26 & 30	Hutchinson Cty., Tex.; Kiowa Co., Okla.; Cameron Parish, La.		58	Planned	
New England States Pipe Line	350	36	N.B.-Maine border	Burrillville, R. I.	420.3	Planned	Partners: Nova; Algonquin Gas; Transco, Texas Eastern
Northern Border Pipeline	270.5	42	North Dakota (Sections 3-4-5)		—	U/C	Reading & Bates Constr. H. C. Price Pipeline Majestic Wiley Contr. Reidel Int'l — rivers.
	308	42	Ventura, Iowa	Dwight, Ill.	900	Planned	
North Dakota Gathering System	113	16	Billings, Dunn, McKenzie, & Williams Cos., N.D.		64	Planned	United Gas P/L, Natural P/L of America; Northern Natural — connects with Northern Border.
	20	12					
Northern Natural Gas Co.	40	4-12	Batesville, Tex.	LaPryor, Tex.	—	Planned	
	13	6 & 10	Offshore Tex.		—	Planned	
	42.5	24	Offshore Refugio Co., Tex.		—	Planned	
	120	4-12	Iowa, Neb., Minn.		15.9	Planned	
	4.3	10	Steel Co., Minn.		1.2	Planned	
Northwest Alaska Pipeline Co.	745	48	Prudhoe Bay	Yukon border	30,000	Planned	
Northwest Pipeline Corp.	80	6 & 12	Lincoln, Unita, & Sweetwater cos., Utah		—	Planned	
Oasis Pipeline Co.	20	10 & 12	Loving Co., Tex.		5	Planned	
Ozark Gas Pipeline Corp.	285	20	Pittsburg Co., Okla.	White Co., Ark.	118	Under Construction	Gregory & Cook; H. B. Zachry; Goldrus Contracting.
Pacific Gas & Electric	40	30	Searchlight, Nev.	S. E. Calif.	—	Planned	
	162	16-36	California		9.4	Planned	
	28	30	California		19	Planned	
	103	36	California		91	Planned	
Pacific Gas Transmission	721	42	Washington	San Francisco	—	Planned	
Panhandle Eastern Pipeline Co.	110	4-12	Wyoming		24	Planned	
	164.7	4, 6, 8, 12	Weld & Adams Cos., Colo.		37.4	Planned	
	60	4-8	Greely, Hamilton, Kearney cos., Kan.		—	Planned	
	56.6	6 & 16	Kan., Okla., Tex.		25.7	Planned	
	26.3	10 & 16	Sweetwater Co., Wyo.		3.9	Planned	
	66.3	20	Woods, Alfalfa, Major, Garfield, Kingfisher cos., Okla.		41.4	Planned	
	10.7	8 & 10	Edward, Kiowa, Pratt Cos., Kan.		4.4	Planned	
	24	4, 6, 8, 10	Major & Blaine Cos., Okla.		6	Planned	
Pioneer Natural Gas	30	2 & 8	Texas Panhandle		1.5	Planned	
Pennsylvania Water & Gas	20.5	12	Wilkes-Barre, Pa.		4.9	Planned	
Red River Pipeline Co.	360	24	Hemphill Co., Tex.	Pecos Co., Tex.	150	Planned	Texas Oil & Gas, Houston Natural Gas, ONEOK, Pioneer, Corp.
Rocky Mountain Natural Gas	41	8	DeBeque, Colo.	Piceance Creek, Colo.	—	Planned	
Rocky Mountain Pipeline System	583	36	Sage, Wyo.	Needles, Calif.	515	Planned	
Sea Robin Pipe Line Co.	5.8	12	South Marsh Island area, offshore La.		5.4	Planned	
Seagull Pipeline Co.	275	24	Cameron Co., Tex. (Offshore)	Bolivar Peninsula, Tex. (Offshore)	—	Planned	
Shell Oil Co.	40	10	Weeks Island, La.	Gibson, La.	—	Planned	
Southern Calif. LNG Terminal	63	32	Ventura, Calif.		—	Planned	
Southern Natural Gas Co.	4.8	16	Offshore La.		6.9	U/C	
	37.2	30	Jasper Co., Miss; Harris Co., Ga.		26.4	U/C	
	16.7	24	Mustang Island, offshore Tex.		18.2	Planned	
	8	6 & 10	Matagorda Island, offshore Tex.		8.8	Planned	
Southwest Gas Corp.	15.5	12	Silver Springs, Nev.	Dayton, Nev.	3.4	Planned	
	60.9	20	Lovelock LNG plant, Nev.	Wadsworth, Nev.	22.7	Planned	
Sugar Bowl Gas Corp.	13	12	Vermilion Parish, La.	LRC Terminal	6	Planned	with Esperanza Transmission
Tennessee Gas Pipeline	228	30	Penn., N.Y., New England		372.6	Planned	Boundary Gas Project
	26	12					
	7	6					
	26.3	16 & 20	Offshore La.		28.4	Planned	
	174.3	16, 24, 30, 36	Offshore/Onshore La, Tex.		274.1	Planned	with Texas Eastern
	26	26 & 36	South Pass area, offshore La.		48.8	Planned	with Columbia Gulf
	10.1	8	Mustang Island, offshore Tex.	Nueces Co., Tex.	5.4	Planned	
	11.4	12 & 16	South Timbalier area, offshore La.		13.3	Planned	
	5.5	12	Monongalia Co., W. Va.		1.41	Planned	
Texas Eastern Corp.	29.5	30 & 36	Delmont, Pa.	Bechtelsville, N.J.	39.1	Planned	
	25.0	6 & 12	Vermilion area, offshore La.		18.3	Planned	
	58.5	36	St. Francisville, La.	Kosciusko, Miss.	—	Planned	
Texas Gas Transmission	10	10	Lincoln Parish, La.		1.9	Planned	
	4	12	High Island area, offshore Tex.		6.3	Planned	
	32.2	20	Cameron Parish, La.		14.5	Planned	
Texas Sea Rim Pipeline	14	14	Sabine Pass area, offshore Tex.		—	Planned	
Trailblazer System	439	36	Rock Springs, Wyo.	Beatrice, Neb.	430	Planned	Natural Gas P/L of America Colorado Interstate, Columbia Columbia Gulf, Mountain Fuel Supply — Irish has coating contract for 439 miles of 36-in.
	358	30					
Trans-Anadarko Pipeline System	635	36	Moore Co., Tex.	Monroe, La.	700	Planned	
Transcontinental Gas Pipe Line Corp.	61	24	Texas		37.8	Planned	
	20.3	36	Cameron & Calcasieu Parishes, La.		24	Planned	
	7.5	12	Louisiana		1.9	Planned	
	19	4, 8, 12	Louisiana		5.7	Planned	
	7.5	6 & 8	Offshore La.		4.7	Planned	
	4.2	6	Galveston area, offshore Tex.		2.5	Planned	
	4	10	Offshore La.		4.4	Planned	
	28.1	10 & 24	Offshore Tex.		24	Planned	
	8.5	20	Offshore Tex.		2	Planned	
	3.3	16	High Island area, offshore Tex.		5.9	Planned	
	12.9	24	Mustang Island area, offshore Tex.		16.9	Planned	FERC OK, 6-81
	88.6	20 & 24	Offshore/onshore Tex.		78.4	Planned	
	110	N/A	Lake Erie	Wharton-Leidy Storage Area	200	Planned	
	31.2	20	Offshore Tex.		9.7	Planned	
	15.3	10 & 12	Offshore Tex./La.		4.4	Planned	
	18.3	2-24	Louisiana		2.2	Planned	
	30.2	10, 20, 24	North Padre Island, Offshore Tex.	Falfurrias, TX.	75.9	Under Construction	Brown & Root
Transcontinental Gas Pipe Line Corp.	3.5	12	Highland Island offshore area, Tex.		4.4	Planned	
	13	24	Wharton Co., Tex.		6.8	Planned	
	7.8	24	Brazos area, offshore Tex.		12.2	Planned	with Columbia Gas Trans.
	8.6	16	Vermilion area, offshore La.		8.2	Planned	
	3	10	Brazos area, offshore Tex.		3.4	Planned	
	1.73	12 & 20	High Island area, offshore Tex.		11.6	Planned	
	5.2	10	Vermilion area, offshore Tex.		4.6	Planned	with Southern Natural, United Gas — FERC OK 6-81

U.S.—Natural Gas Pipelines

COMPANY	MILES	SIZES (INS.)	FROM	TO	COST ($MILLIONS)	STATUS	CONTRACTORS/NOTES
	3.9	10 & 24	Brazos area, offshore Tex.		13.5	Planned	with Columbia Gulf
	3	8	Mustang Island, offshore Tex.		3.3	Planned	
	16.7	24	Mustang Island, offshore Tex.		17.3	Planned	with Northern Natural
	.43	16	Brazos area, offshore Tex.		3.6	Planned	
United Gas Pipeline Co.	2.8	10	High Island area, offshore Tex.		4.2	Planned	
	115	30	Ft. Bend, Co., Tex.	San Jacinto Co., Tex.	81	Planned	
	25.8	36	Bayou Sale, La.	Napoleonville, La.	36.8	Planned	
	6.3	4 & 6	Slidell, La.		1.3	Planned	
	6.06	6	Shelby Cty., Tex.	Panola Cty., Tex.	—	Planned	
	11.68	8	Harrison Cty., Tex.		—	Planned	
	8.01	10					
	1.4	6	W. Cameron Area, Block 538, Offshore La.		—	Planned	
Valero Energy Corp.	45	24 & 30	Provident City, Tex.	Wharton County	41.5	Planned	
Western LNG Terminal	286	42 & 48	Pt. Conception, Calif.	Los Angeles	—	Planned	
Western Gas Interstate Co.	55	12	S. E. New Mexico	Pyote, Tex.	5.8	Planned	

U.S. — Crude Oil Pipelines

COMPANY	MILES	SIZES (IN.)	FROM	TO	COST ($MILLIONS)	STATUS	CONTRACTORS/NOTES
Bigheart Pipeline Co.	60	2-6	Oklahoma		2.5	Planned	
Department of Energy	14	16	Eastern Ky. strategic reserve		—	Planned	
	13	20	Southern Ohio strategic reserve		—	Planned	
Grand Valley Oil Co.	180	16	S. E. Utah	Rangely, Colo.	—	Planned	
Getty Oil Co.	70	16	McKittrick, Calif.	Coalinga, Calif.	—	Planned	
La Sal Pipe Line Co. (Exxon, Texaco)	314-320	12 & 16	Parachute, Colo.	Casper & Rangely, Wyo.	100	Planned	Carry shale oil from Colony Oil Shale Project (Tosco & Exxon)
Frontier Pipeline Co.	300	20	Uinta Co., Wyo.	Casper, Wyo.	—	Planned	
New England Energy	35	24	Portland, Me.	Sanford, Me.	—	Planned	
Northern Tier Pipeline	1491	40, 42	Port Angeles, Wash.	Clearbrook, Minn.	1600	Planned	Butler (E) and Williams Brothers (E)
Northville Industries	211	30 & 36	Freeport, Tex.	Texas City-Galveston	—	Planned	Brown & Root (E)
Provident Energy Co.	204	16	Mobile, Ariz.	Kingman, Ariz.	—	Planned	1983 Construction
U.S. Navy	135	3-20	Naval Petroleum Reserve	Redland, Calif.	—	U/C	ARB inc.
Wallace & Wallace Chemical & Oil Co.	214	22-30	Mobile, Ala.	Tuskogee, Ala.	—	Planned	Ford, Bacon & Davis (E)

U.S. — Product Pipelines

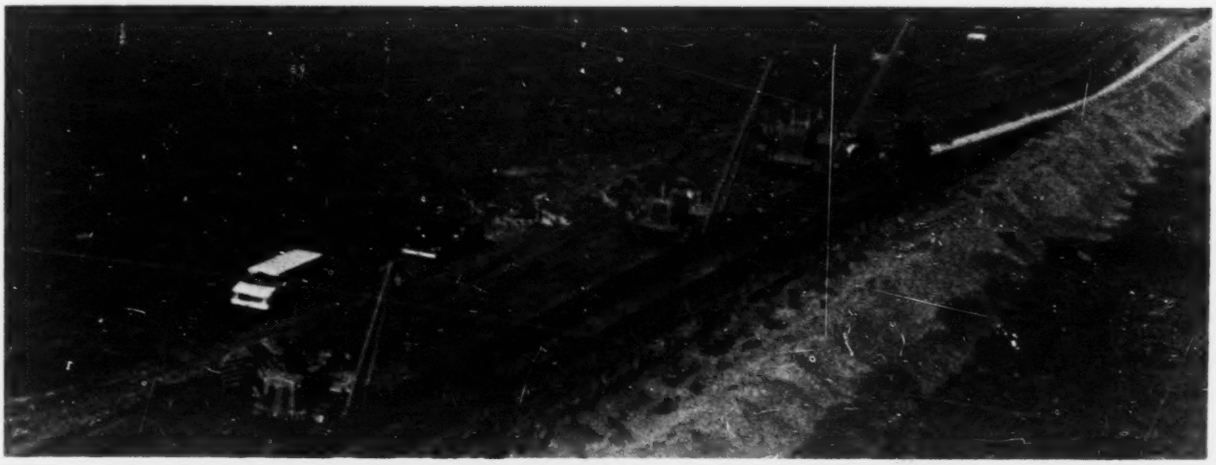
COMPANY	MILES	SIZES (INS.)	FROM	TO	COST ($MILLIONS)	STATUS	CONTRACTORS/NOTES
Ashland Pipeline Co.	74	8	East Sparta, Ohio	Heath, Ohio	—	Planned	
	5	6	Western Kentucky		—	Planned	
Alaska Interstate, Dow Chemical, Shell Chemical	800	16-20	Prudhoe Bay	Anchorage or Valdez	1200	Planned	
Barbour Energy Co.	390	20	Brownsville, Tex.	Houston	—	Planned	Ford, Bacon & Davis (E)
Big Three Industries	67	12	Victoria, Tex.	Bay City, Tex.	—	Planned	
Coastal States Crude Gathering Co.	12.8	6	East Whites Point, Tex.	Clarkwood, Tex.	—	Planned	LPG
Colonial Pipeline Co.	240	16	Augusta, Ga.	Charleston, S. Car.	—	Planned	
	190	36	Baltimore, MD	Linden, N. J.	—	Planned	
Doyon Ltd.	255	20	Prudhoe Bay	Nikishka, Ak.	1300	Planned	NGL and crude oil
	143	16					
Enterprise Products Co.	145	8	Sorrento, LA	Petal, MS	—	Planned	LPG
Exxon Pipeline Co.	66	8	Houston	Beaumont	—	Planned	
Farmland Industries	70	12 & 16	Louisiana		—	Planned	
Getty Pipeline	25	16	Delaware City, Del.	Marcus Hook, Pa.	10	Planned	
Gulf Refining	36	10 & 14	West Texas		—	Planned	
Mapco	376	3, 6, 8	Extensions to system		—	Planned	
Phillips Petroleum	820	10	Williston, N.D.	Conway, Kan.	—	Planned	
Product Energy Co.	30	12	Mobile, Ariz.	Phoenix, Ariz.		Planned	1982 Construction
Seagull Petrochemical Pipeline Corp.	15	4	Norco, La.	LaPlace, La.		Planned	
Southern State Pipeline Co.	32	12	Norco, La.	Sorrento, La.		U/C	
Transgulf Pipeline	890	24	Baton Rouge, La.	Ft. Lauderdale, Fla.	140	Planned	Conversion from gas
Texas Eastman	130	8	Longview, Tex.	Shreveport, La.		Planned	FB&D (E)

U. S. — Slurry Pipelines

COMPANY	MILES	SIZES (IN.)	FROM	TO	COST ($MILLIONS)	STATUS	CONTRACTORS/NOTES
Allen-Warner Valley Energy Systems (Nevada Power Co.)	183	20 & 24	Alton, Utah	Las Vegas, Nev.	270	Planned	
Chevron Chemical Co.	80	Unk.	Vernal, Utah	Rock Springs, Wyo.	—	Planned	Phosphate line
Coalstream Pipeline Co. (Continental Resources)	1500	24-48	Kentucky	Florida	3000	Planned	Fluor (E)
Energy Transportation Systems Inc.	1440	38	Wyoming	Baton Rouge, La.	2000	Planned	Bechtel (E)
Pacific Bulk Transportation Systems (Boeing Engineering and Construction Co.)	650	Unk.	Emory, Carbon Cos., Utah	Port Hueneme, Calif.	500	Planned	Boeing (E)
Powder River Pipeline Inc.	1923	42	S. E. Montana	Great Lakes area	1260	Planned	
San Marco Pipeline Co. (Houston Natural Gas, Rio Grande Industries)	900	20 & 24	S. E. Colorado	Texas Gulf Coast	800	Planned	
Snake River System (Northwest Energy, Gulf Interstate)	1100	20 & 24	N. E. Wyoming	Idaho, Oregon	500	Planned	
Tesoro Petroleum Corp.	1000	30	Kentucky	S. E. U.S.	1000	Planned	
Virginia Power Co.	300	12-36	Proud, W. Va.	Portsmouth, Va.	250	Planned	
Wytex System (Texas Eastern, Brown & Root)	1260	36,40	Power River Basin, Wyo.	Houston area	1800	Planned	Brown & Root (E)

U.S. — Carbon Dioxide Pipelines

COMPANY	MILES	SIZES (IN.)	FROM	TO	COST ($MILLIONS)	STATUS	CONTRACTORS/NOTES
Amoco Production Co. (Bravo Dome Pipeline)	300	20	Bravo Dome, N.E. N. Mex.	Permian Basin Field, Texas	—	Planned	In design stages
ARCO Pipeline Co. (Sheep Mountain Pipeline)	405	20	Walsenburg, Colo.	Seminole Field, Gaines Cty., Tex.	—	Planned	In design stages
	12	Various	Field lines in Colo. and Texas.				
Carbon Dioxide Technology	40	8	Lubbock, Tex.	Post, Tex.	—	U/C	Brown & Root
Highland Resources	N.A.	N.A.	Beaumont, Tex.	Orange, Tex.	—	Planned	
Northwest Pipeline Co. and Transwestern Pipeline Co.	125	N.A.	Ignacio, Colo.	Gallup, N. Mex.	—	Proposed	
Rocky Mountain CO_2	550	N.A.	Big Piney, Wyo.	Williston, N. Dak.	—	Planned	
Shell Oil Co.	503	30	Cortez, Colo.	Denver Unit at Wasson Field, NW of Midland, Tex.	—	U/C	Pipe coating underway; '82 construction.
Texaco	25	14	Luling, La.	Paradis Field	—	Planned	



1982 To Be Big Year In Canada For Big-Inch Pipelining

by L. O. Rowland, *Canadian Editor*

A second year of high volume big-inch pipeline construction is in store for Canadian contractors and may even top 1981 that has brought the first recovery of a whole decade of extreme depression in the big-inch category. The 1981 volume has topped out at about 830 miles of 24-inch and larger and included the first substantial 48-inch project since 1973.

The first project to be awarded for 1982 is the winter program of TransCanada PipeLines Ltd. in the muskeg regions of eastern Manitoba and Northwestern Ontario. The 128 miles of 42-in. loop of the existing main gas transmission line were awarded to Majestic Wiley Contractors Ltd. It is a normal winter job on frozen ground, with completion scheduled for Feb. 28, before spring breakup.

Next to come up will be the completion of the Canadian eastern leg of the Alaska Natural Gas Transmission System. Foothills Pipe Lines (Yukon) Ltd. has 128 miles of 42-in. to fill in the two gaps in the southern Alberta segment, remaining after the rest of the portion from Clearwater compressor station to the Saskatchewan boundary was laid in the 1981 summer season. Foothills will call tenders on Feb. 1, award the contract by March 1 so that the contractor can move all equipment onto the right-of-way before the spring road bans, and kick off as soon as the right-of-way is suitable for travel. There is a close completion deadline of Aug. 1 so that the whole eastern leg can be in service by Sept. 1 to coincide with the in-service schedule for the Northern Border pipeline with which the Foothills system connects at Monchy, Saskatchewan.

TransCanada plans to spend nearly $800 million additional in 1982 for two more projects which were awaiting National Energy Board approval following public hearings. One is a major looping project to continue the 1981 looping. It comprises 181 miles, made up of 115 miles of 48-inch in Saskatchewan and Manitoba, 50 miles of 42-inch in northern Ontario and 16 miles of 36-inch in Manitoba on the export lateral.

The second TCPL project is the long-planned "short cut" main line from North Bay to a point near Morrisburg on the Toronto-Montreal main line where the Ottawa lateral takes off from this line. The 253-mile, 42-in. line will be in entirely new right-of-way, cutting across on the hypotenuse of the triangle which it will form with the present main line from North Bay south to Toronto and from Toronto northeast to Montreal.

Purpose of this line is, in effect, to loop the much longer North Bay/Toronto/Montreal route in a more economical way by cutting about 100 miles off the total distance of the original line. It will also provide an express route for gas to the far eastern provinces when the TQ&M line is built, and for gas going to the northeastern states to whatever extent the large contracts signed with American pipeline companies during the past year are approved by the National Energy Board. These export proposals have yet to come to public hearing before the NEB.

Both the looping project and the new main line are planned for normal summer construction, on the assumption that the NEB will move promptly, recognizing the logistical problems of a short summer in the western provinces and the congested region in Ontario where the new pipeline passes through many heavily settled and intensively cultivated areas. Scheduled completion dates are late fall for both projects.

Trans Quebec & Maritimes Pipeline Inc. closed tenders on Nov. 23, under its alternate name Gazoduc Trans Quebec & Maritimes Inc., for the long delayed main line from Boisbriand, near Montreal, to Trois Rivieres, the first leg of the line from Montreal to Quebec City. The project consists of 92 miles of 24-inch and is planned to kick off by Jan. 15 for a scheduled completion on Nov. 1, 1982.

These five principal items add up to 785 miles. Some tentative plans by Foothills and Nova, an Alberta Corporation may materialize early enough to add another 100 miles or so. The start of 56-in. pilot construction on Foothills has been delayed officially until the winter of 1982-83, but this is not definitive and could be brought forward to the fall of 1982. Nova also has some potential in expansion of its existing system in Alberta, depending substantially on early developments in the various pending export projects.

In the small-inch category, Nova will be the leading main line builder in 1982, with a massive program of lateral gas transmission lines which could exceed 400 miles if regulatory approvals come quickly enough and producer gas contracts justify the projects.

The firm items begin with the Liege lateral, 94 miles of 10 and 12-in. to move gas from the Liege field in northeastern Alberta to a point south of the Athabasca oil sands area on an existing main gas line. Next is the Cutback lateral in the Deep Basin in the Gold Creek area of northwestern Alberta, 45 miles of 16

CANADA—Natural Gas Pipelines

COMPANY	MILES	SIZE (IN.)	FROM	TO	COST ($MILLIONS)	STATUS	CONTRACTORS
Aquitaine Co. of Canada Ltd.	42	8, 16	Hanlan Field	Ram River Processing Plant	—	Planned	Comp. Spring 1982
Alberta Energy Co. Ltd.	300	2 to 8	Suffield Block gathering system		—	Planned	
British Columbia Hydro and Power Authority	211.8	N/A	Delta (B.C. Mainland)	Nanaimo (Vancouver Island)	231	Planned	Line to go under Strait of Georgia
Dome Petroleum	67	3 to 10	Primrose-Kirby Area	—	—	Planned	
Canadian Hunter	63	4, 6, 8, 10	Deep Basin gathering system		—	Planned	
Canadian Western Natural Gas	22	12	Okotoks	Cayley, Alta.	—	Planned	
	15	16	Priddis	Calgary	—	Planned	
Foothills Pipe Line (Alberta) Ltd.	394	56	Western Alberta		—	Planned	
	99	36	Caroline, Alta.	Crowsnest, Alta.	—	Planned	Approved by NEB; to be built later
	740	34	Whitehorse	MacKenzie Delta	—	Planned	Dempster lateral (1987 Or 1988)
Foothills Pipe Lines (North BC) Ltd.	439	56	Northern BC		—	Planned	
Foothills Pipe Lines (South BC) Ltd.	53	36			—	Planned	Approved by NEB to be built later
Foothills Pipe Lines (Sask.) Ltd.	161	42	Monchy, Saskatchewan	James River (Alberta border)	—	U/C	Majestic Wiley
Foothills Pipe Lines (Alberta) Ltd.	128	42	Southeastern Alberta		—	Planned	1982 Construction
Foothills Pipe Lines (South Yukon) Ltd.	266	48	Southern Yukon		—	Planned	
	251	56	Southern Yukon		—	Planned	
East Coast Pipelines Ltd.	1000	36	Sable Island	Montreal	—	Proposed	Techman, Ltd. (E)
Gulf Canada Resources Ltd.	155	2 to 16	Hanlan, Alta., area		—	Planned	
Hudson's Bay Oil & Gas Co.	35	4 to 6	Alberta		—	Planned	
Nova Corp.	45	16, 20	Laterals		—	Planned	
	58	6, 16, 20	Laterals		—	Planned	
Pacific Northern Gas	75	16	Nanaimo, B.C.	Comox, B.C.	75	Planned	1983 Completion
	54	12	Nanaimo, B.C.	Victoria, B.C.			
	29	6	Comox, B.C.	Campbell River, B.C.			
Pan Canadian Petroleum	210	2 to 6	Southeastern Alberta		—	Planned	
Peace Pipeline Ltd.	144		Grande Prarie	Fox Creek	—	Planned	
Polar Gas Project	3100	30, 36, 42	Melville Island	Longlac, Ont.	7000-8500	Planned	Late 80's
Saskatchewan Power Corp.	6	4	New Osgood	Zenon Park Loop	—	Planned	
Shell Canada Resources Ltd.	20	3 & 6	NW Alberta		—	Planned	
Texaco Canada Inc., CDC Oil & Gas Co.	40	10	Mildred Lake Alberta	Texaco Pilot Oil Sands Plant	—	Planned	
TransCanada Pipelines Ltd.	128	42	Eastern Manitoba (Loops)	NW Ontario	—	U/C	Majestic Wiley
	115	48	Sask. Ont., Mant. Loops		317	Planned	
	50	42					
	16	36					
	74	30	Montreal	Quebec City	—	Planned	
	26	30			—	U/C	Banister Pipelines
	253	42	North Bay	Morrisburg, Ont.	476	Planned	Ottawa Lateral
Trans Quebec & Maritimes	460	30	Levis/Lauzon (Near Quebec)	Halifax & Grace Bay, N.S.	360	Planned	Approved by NEB Aug. 1981
	600	Various	Distribution laterals in New Brunswick & Nova Scotia		—	Planned	
	92	24	Boisbriand	Trois Rivieres	—	U/C	
	1000	Various	Montreal	Quebec plus other laterals	900	Planned	
Union Gas Ltd.	22	42	Bright-Owen Sound	Kerwood-Caradoc	—	Planned	1982
Westcoast Transmission	83	12 & 24	British Columbia		—	Planned	
	41	36	British Columbia		—	Planned	
	30	6, 8, 26	British Columbia		—	Planned	

CANADA—Crude Oil Pipelines

COMPANY	MILES	SIZE (IN.)	FROM	TO	COST ($MILLIONS)	STATUS	CONTRACTORS
Home Oil Co.	300	4-10	Grand Prarie	Swan Hills	—	Planned	
Husky Oil Operations, Ltd.	90.5	16 & 12	Cold Lake Field	Lloydminster	—	Planned	Approved; 1982 Construction
Interprovincial Pipe Line (NW) Ltd.	533	12	Norman Wells, NWT	Zama Lake, Alta.	360	Planned	NEB approved but delayed until 1985
Transmountain Oil Pipeline, Ltd.	571	30 & 36	Edmonton	U.S. Border	—	Planned	NEB approved; deferred
	30	36	Sumas Wash.	U.S. Border	—	Planned	Deferred

CANADA—Products Pipelines

COMPANY	MILES	SIZE (IN.)	FROM	TO	COST ($MILLIONS)	STATUS	CONTRACTORS
Alberta Products Pipe Line Ltd.	192	10	Edmonton	Calgary	—	Planned	Associated-Pullman Kellogg Ltd. (E)
Hudson's Bay Oil & Gas Co. Ltd.	94	6	West Pembina	Rimbey Gas Plant	—	Planned	
Husky Oil Operations, Ltd.	90	6	Cold Lake	Lloydminster	—	Planned	1982 Construction: Algas Engr'g. Services (E)
Petro Canada Cactus Lake Project	41	N/A	Cactus Lake Field	Murphy	—	Planned	Condensate Line

CANADA — Slurry Pipelines

COMPANY	MILES	SIZES (IN.)	FROM	TO	COST ($MILLIONS)	STATUS	CONTRACTORS/NOTES
Alberta Economic Development Energy, and Natural Resources Ministries	500	Unk.	Hinton, Alberta	Pacific Coast		Planned	Fluor (E)

and 20-in. The Demmitt lateral 14 miles of 16-in. is designed to serve a new gas processing plant north of Grande Prairie in the Deep Basin. The Robb lateral from the Hanlan central foothills gas plant being built by Gulf Canada will take 24 miles of 20-in. A package of three laterals, Kirby North loop, Graham and Chard, amounts to 50 miles of eight and six-inch, in northeastern Alberta. Tenders have been called for all of these and two had been contracted up to mid November. All are winter jobs, for completion before spring, for a total of 227 miles.

Gulf Canada has a major sour gas gathering system leading into its Hanlan gas plant, for summer construction, with a total of 155 miles of 16-inch down to two-inch comprising sour gas service main lines coupled with sweet fuel gas lines and water disposal lines. Canadian Hunter proposes 63 miles of 10, 8, 6 and 4-in. in the Deep Basin. Aquitaine Company of Canada Ltd. has a sour gas lateral extension in the same area, 42 miles of 16 and 8-in. from the South Hanlan area to its Ram River gas plant. Alberta Energy Co. Ltd. plans about 300 miles of small-inch gathering lines in the Suffield Block.

PanCanadian Petroleum has a firm commitment for 210 miles of 2 thru 6-in. gathering lines in southeastern Alberta.

In product and gas liquids projects, the principal item is the long deferred looping of the entire Edmonton-Calgary products line of Alberta Products Pipe Lines Ltd. (a Gulf Canada subsidiary) with 192 miles of 10-in., which is to be re-tendered for summer construction. Hudson's Bay Oil and Gas Company Ltd. intends to build 94 miles of 6-in. LPG and condensate line from the West Pembina field to the Gulf Rimbey gas plant.

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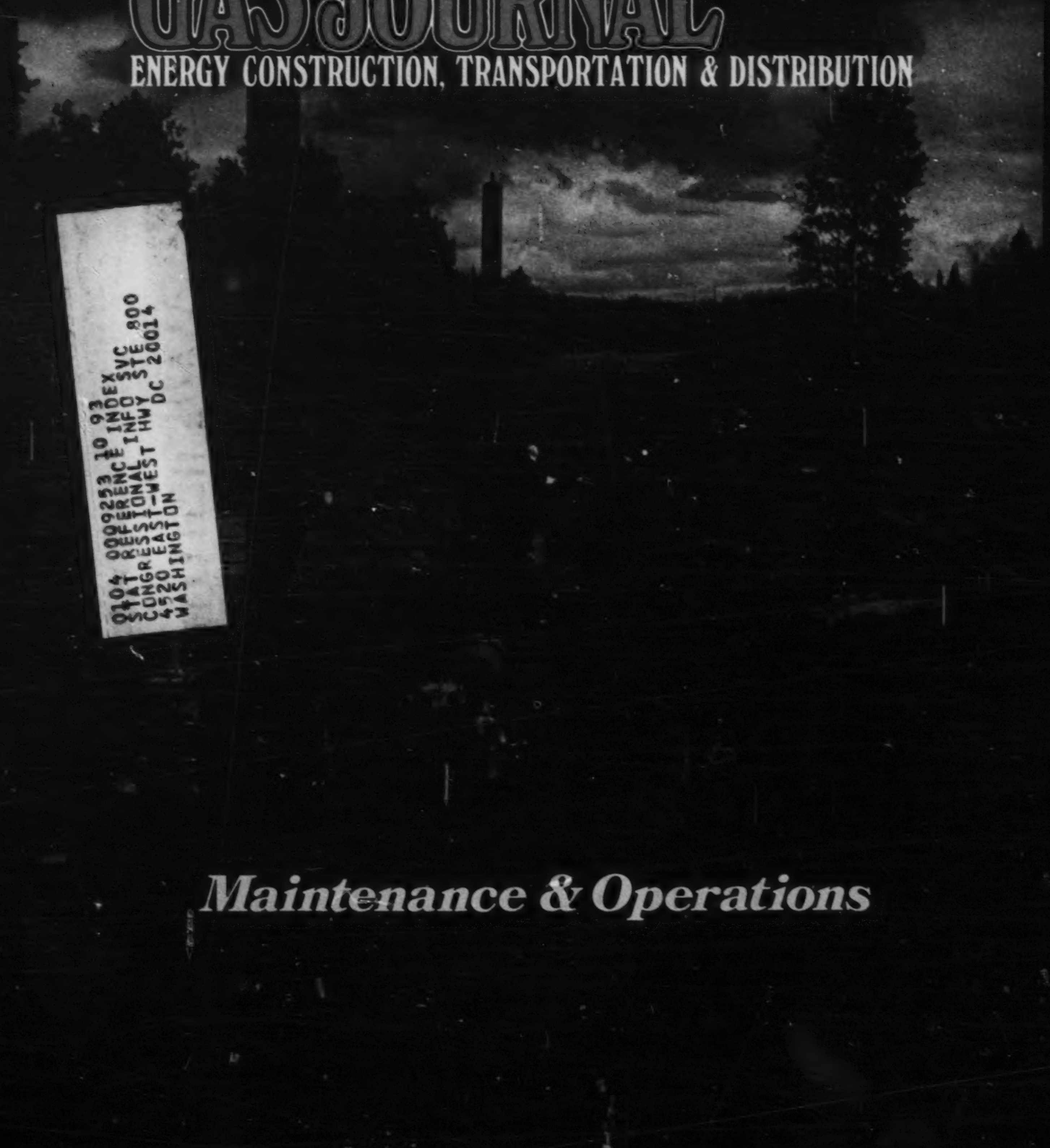

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COVER
Pipeline maintenance takes many forms – such as this project to replace a faulty valve on a 30-in. crude oil pipeline in Michigan's Upper Peninsula; two Stopple® Plugging Machines were used to make bypass so line was never shut down while old valve removed and new one inserted.

– Photo courtesy T. D. Williamson, Inc.

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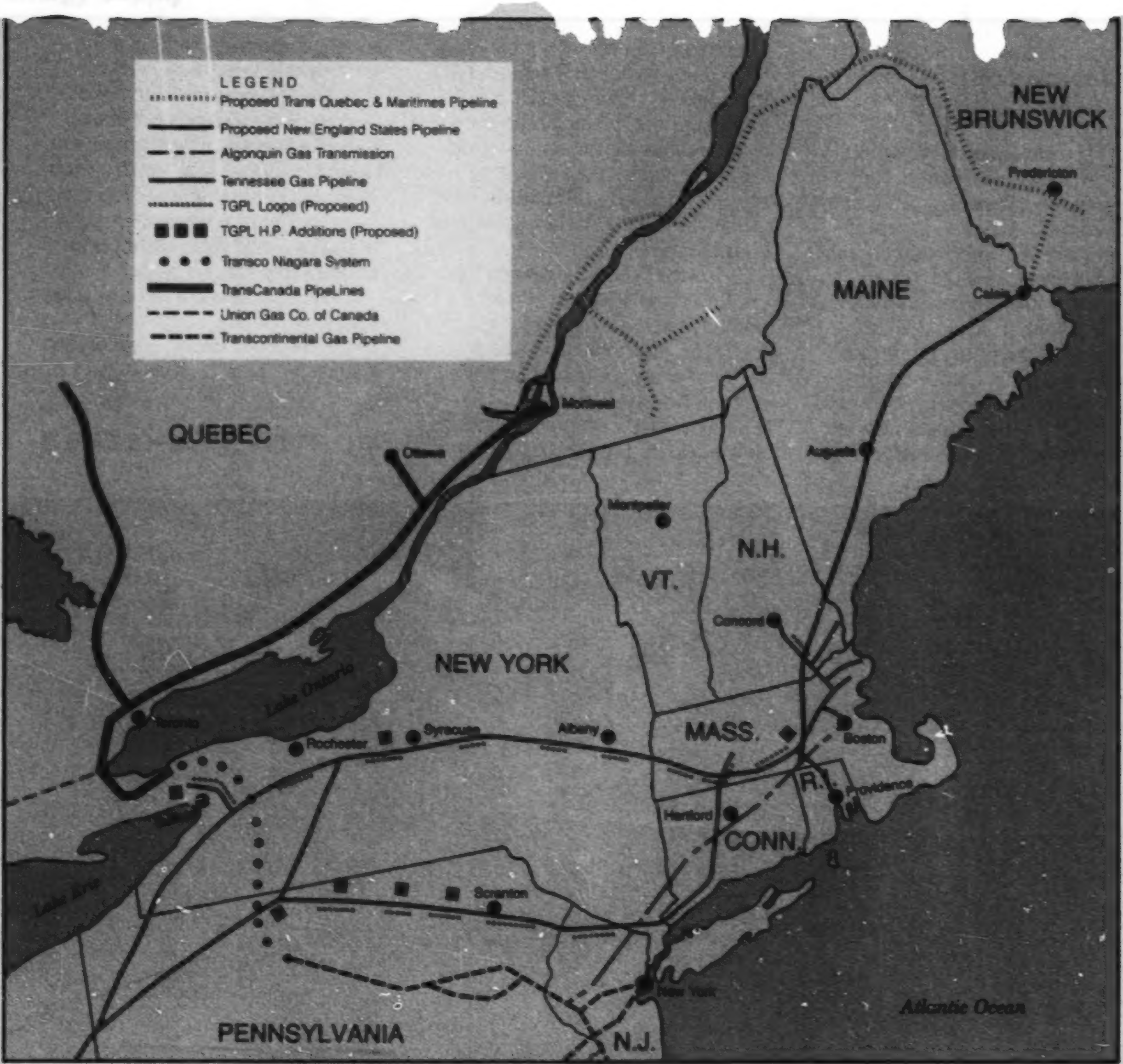
Urethane Foam Has Many Maintenance/Operation Uses 59
Two-part pre-pressurized urethane foam froth pack can be used with foam probe to seal off leaking mains and services, plug abandoned lines, many other uses.


LEGEND
Proposed Trans Quebec & Maritimes Pipeline
Proposed New England States Pipeline
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TGPL Loops (Proposed)
TGPL H.P. Additions (Proposed)
Transco Niagara System
TransCanada PipeLines
Union Gas Co. of Canada
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NEW BRUNSWICK
Fredericton
MAINE
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PENNSYLVANIA
Atlantic Ocean

Gas Lines Chasing Huge Northeastern Market

by **Jim Watts**, *Assistant Editor*

Gas for an energy-hungry Northeast U.S. is the driving force behind three projects to bring Canadian gas to the New England-New York area. None of them has yet made it through the double-barreled governmental review maze, where bodies from both sides of the border must approve, but by the mid-1980s at least one will be bringing millions of cubic feet of gas into the U.S. daily to heat homes, fuel industrial facilities, and provide a clean, efficient alternative to an area heavily dependent upon heating oil.

The three proposals are the New England States Pipeline (Algonquin Gas Transmission Co., Transcontinental Gas Pipe Line Corp., Texas Eastern Transmission Corp., and Nova Corp.); Boundary Gas Inc. (a consortium of 14 gas utilities with Tennessee Gas Pipeline Co. providing transportation); and Transco's proposal for a line from Niagara Falls to Pennsylvania.

Both countries stand to benefit from the projects. For Canada, the sale of gas to New England provides a steady market for massive quantities of gas, makes it economically feasible to build a pipeline from gas-rich Alberta that will serve eastern Canada as well, and ensures there will be a transportation network in the Maritimes for use when production begins off Newfoundland and Nova Scotia. For the U.S., the gas from Canada will help reduce the nation's dependence on foreign oil and provide additional supplies when, as happened last winter, cold weather strains utilities' efforts to provide enough gas.

New England States Pipeline

The New England States Pipeline, a 360-mile, 36-in. line from near Calais, Maine, to Burrillville, R.I., is a joint partnership of Algonquin Gas Transmission, Transco, Texas Eastern Transmission, and Nova Corp., each of which will have a 25% financial interest in the project. The 300 MMcf transported daily from Canada will be shared equally by Algonquin, Texas Eastern, and Transco.

The Battle For New England Gas Supply – Summary of Proposals

Project	Miles	Sizes (in.)	Daily Volume (Mcf)	Cost (Millions)
Boundary Gas Inc.	261	10 to 42	300,000	$372.57
Niagara Pipeline	158	42	1,113,000	$402.3
New England States Pipeline	360	36	305,882	$560.78

The project was originally proposed as a 30-in. line but was upgraded to 36-in. prior to the filing with FERC on Oct. 9, 1981. In addition to the 360 miles of 36-in., the project calls for 65,000-hp compression at four stations. A meter and regulator stations will be built at Burrillville, where the gas enters the Algonquin system, and a regulator station at Calais, where the gas crosses the international border.

Total cost of the project is estimated at $560,778,000. Construction costs account for more than $420.3 million. Line is designed to operate at a maximum pressure of 900 lb with designed deliverability of 305,882 Mcf a day. With the addition of the four stations comprising 65,000-hp, the maximum deliverability goes up to 850 MMcfd.

William Belkin of Algonquin says the project has two purposes.

"First, it makes more gas more available," Belkin says. "Second, we think it important to get this line in place so that, when gas comes ashore from Nova Scotia and Newfoundland, the facilities will be there to allow the Canadians to take advantage of that new supply."

Pipeline's route has been determined by using the "corridor" concept (utilizing existing pipeline, highway, and railroad right-of-ways) to minimize environmental and socioeconomic problems during construction and operation, Belkin says. Aerial surveys of all routes were completed in 1979.

Assuming all regulatory hurdles are passed in a reasonable time, line could be operational by 1984. "That's an optimistic date," Belkin concedes. "That's really the earliest possible date."

Gas will be purchased from Pan-Alberta Gas Ltd. Firm has applied for a 15-year export license with an annual volume of 112 Bcf, and a total volume over the contract's lifetime of 1.8 Tcf.

Export licenses have been filed with Canada's National Energy Board for all three projects, taking their place along with at least a dozen similar applications now pending. Joint hearings are planned on all the applications for export in the first six months of 1982.

International politics are expected to be a major factor in the license review process. Relations between Ottawa and Washington were strained last year by the announcement of Trudeau's national energy policy that restricts U.S. participation in Canada's oil and gas industry. Combined with some Canadian conservationists' worries that the sales will draw down Canada's enormous gas reserves and U.S. fears that the imports will make the Northeast dangerously dependent on Canadian gas, situation is shaping up where politics could play a bigger role than the already demonstrated need for the gas.

A recent report from the NEB says there isn't enough gas in field connected to production facilities — gas treating plants and pipelines – to justify additional exports. However, the NEB's "current deliverability test" ignores the fact that companies are reluctant to expend the millions of dollars needed to provide those facilities without a guarantee that the gas has a market.

Boundary Gas

Boundary Gas Inc. was born out of necessity. Fourteen gas utilities in the New York-New England area determined they would be forced into severe curtailments by the 1980s unless another supply was obtained. Because 13 of the 14 already purchased their gas through the Tennessee Gas Pipe Line system, they went to Tenneco for help.

"They are buying the gas, and we've got to build the additional facilities to deliver it," says George O. Jackson of Tenneco. "They asked for the gas and they asked us to provide transportation."

Participants in Boundary Gas and their daily volumes include:

NEW YORK-NEW JERSEY AREA	MMcfd
Brooklyn Union Gas Co.	40
Consolidated Edison of New York	40
Long Island Lighting Co.	23
New Jersey Natural Gas	14
National Fuel Gas Supply	9
NEW ENGLAND AREA	
Bay State Gas Co.	18
Berkshire Gas Co.	2
Boston Gas	13
Connecticut Gas Co.	9
Fitchburg Gas and Electric Light	1
Gas Service Inc.	1
Haverhill Gas Co.	3
Manchester Gas Co.	2
Valley Gas Co.	2
TOTAL	177

Boundary Gas filed application with the Economic Regulatory Administration Dec. 19, 1980, for authorization to import 185 MMcfd for delivery to Boundary's 14 customers beginning no earlier than Nov. 1, 1982. Line will have the capacity to handle 300 MMcfd, and TransCanada has applied for an export license for 300 MMcfd over a 10-year period.

Total cost of the project is estimated at $372,571,000 (1982 dollars). Project will include 179.1 miles of 30-in. loops in New York, Massachusetts, Pennsylvania, and New Jersey; 48.6 miles of 42-in.; 8.6 miles of 10-in.; and 25 miles of 12-in. Total compression required is 30,465 hp, with additional facilities including new measurement and regulator stations along the Tennessee Gas system. Proposal was filed with FERC April 22, 1981.

Transco Niagara System

Transcontinental Gas Pipe Line Corp., one of the participants in the New England States line, is one of the major U.S. purchasers of Canadian gas. Transco currently buys gas from Sulpetro and Union Gas Ltd., and Canadian sources may soon account for 20% of Transco's volume.

Transco plans to build a line across New York and Pennsylvania that replaces plans for a line that would have begun beneath Lake Erie. Current project, Transco Niagara Pipeline System, consists of 158 miles of 42-in. Line will begin five miles north of Niagara Falls and terminate at Transco's Wharton-Leidy storage field in north central Pennsylvania. Cost is $402.3 million.

Earlier project, the Lake Erie line supplanted by the Niagara line, would have been 110 miles of large-diameter pipe. Estimated cost was $200 million.

"We believe in the U.S. suppliers but in the future we feel we'll need every possible source of gas," says Barbara Johnson of Transco. "Two-thirds of our market is north of the Potomac River, and Canada provides us with another source of gas supply closer to our customers than the Gulf Coast fields. Really, it'll help all our customers by making more gas available."

Transco has signed an agreement with TransCanada PipeLines calling for delivery of 300 MMcfd for 10 years beginning no earlier than Nov. 1, 1982. Line will transport 1.113 Bcfd, with an ultimate capacity of 2 Bcfd. A compressor station with 38,000-hp will be built at the northern end and a station with 19,000-hp is planned for the southern end.

A portion of the gas will be stored for winter delivery. A total of 40 Bcf of storage capacity will be provided by Union Gas Ltd. in Ontario and by ANR in Michigan. Transportation to and from the outlying storage facilities will be through Union Gas and Great Lakes Gas Transmission Co. systems. **P&GJ**

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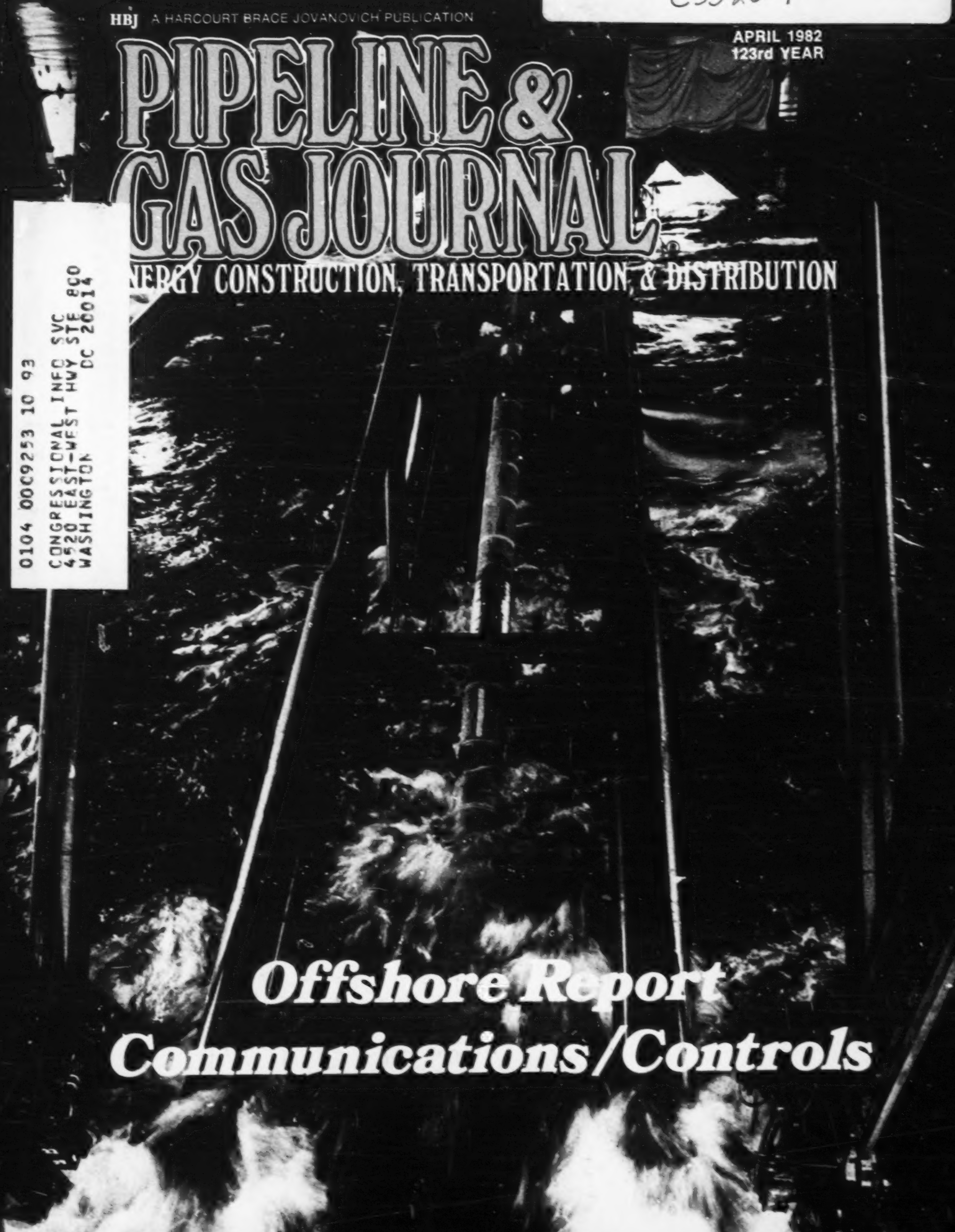

Offshore Report

Communications/Controls

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International Pipeline & Gas Utility Design, Construction & Operation

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An integrated computer procedure for predicting operational limits of a deepwater pipe-lay vessel developed by Saipem includes both vessel simulation and pipe simulation programs.

Gel-Plug Technology Used To Clean FLAGS Offshore Line 26
FLAGS line was successfully cleaned using an unique gel-plug technology that enabled an estimated 350 tons of debris to be removed from the pipe wall, suspended, and transported through the pipeline.

How To Make Hot Tap Connections By Underwater "Dry" Welding 34
Branch connections by underwater welding and hot tapping have been successfully made in the Gulf of Mexico by several contractors; here are details on methods employed and how they can be best applied.

Buckeye Modernizes Control System — One Computer Replaces Seven 40
Buckeye Pipeline's 3600-mile system stretching over six states once was controlled using seven different incompatible computer systems; that bottleneck has been replaced with one system.

How Telemetering Can Help Gas Distribution Operations 48
Gas distribution system can profit greatly from proper application of telemetering that permits monitoring and control of city gate stations, district regulator stations, measuring stations, and other facilities.

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Valero Energy is developing underground natural gas storage in salt domes as part of program to meet peak day demands on its transmission system.

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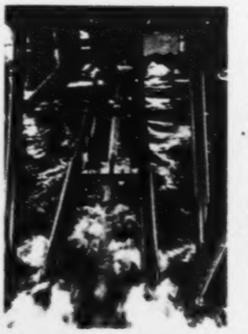
Contruction Equipment Specifications 66
P&GJ's exclusive "spec sheets" on construction equipment used by pipeline and gas distribution contractors and operating companies features cranes — part 3.

Solar-Powered Flow Computers 72
Advent of very-low-powered flow computer systems that can be powered by solar devices points to diminishing dependence on chart recorders and mechanical correctors.



COVER

Pipe comes down ramp of the *Castoro Sei*, the giant semisubmersible deepwater pipelay vessel operated by Saipem S.p.A. and controlled by unique computer programming that compares vessel simulation with pipe simulation. Detailed discussion begins on page 17.

— photo courtesy Saipem S.p.A.

Mixed Earnings Reported by Oil and Gas Industry

by Cindy Mays, *Assistant Editor, Energy Management Report*

Oil industry earnings were mixed for the fourth quarter as, once again, companies with major domestic operations recorded profit gains, while those engaged heavily in foreign operations experienced losses.

Higher prices for domestic oil and gas due to oil decontrol helped Atlantic Richfield earn 18 percent more, while Shell rose 12 percent, and Union Oil of California jumped 33 percent.

Because of weak European economies, Gulf Oil earnings dropped one percent, Exxon, 21 percent and Standard Indiana, 8 percent.

The 68 oil companies who participated in our survey show an overall 8.5 percent increase in net income over last year. Profit margin for the group fell from 6.2 percent to 5.5 percent.

American Petrofina's refining and marketing profits were adversely affected throughout the year by reduced levels of operations due to declining demand and compression of margins. Fourth quarter earnings dropped 12 percent.

Oil and gas increases stemming from higher production as well as higher prices for both oil and gas, resulted in a 68 percent increase in net earnings for Noble Affilates.

Natomas posted net earnings of $48.8 million compared to $44.1 million last year mostly from gains in the company's international petroleum, geothermal, petroleum marketing and real estate operations.

Even though Pennzoil's oil and gas division showed an increase, depressed copper and molybdenum prices, combined with lower sulphur sales volumes, offset the gain, causing the 30 percent drop in earnings.

Solid fourth quarter gains in Diamond Shamrock's energy businesses, combined with a good

FOURTH QUARTER GAS COMPANY FINANCIAL REPORTS

	Three months ending December 31**						Twelve months ending December 31**							
	Revenues ($000)			Earnings* ($000)			Revenues ($000)			Earnings* ($000)			Profit Margin	
Company	1981	1980	% Chg.	1981	1980	% Chg.	1981	1980	% Chg.	1981	1980	% Chg.	1981	1980
Alabama Tennessee N.G.	30,263	27,067	+ 11.8	1,651	1,589	+ 3.9	116,805	91,907	+ 27.1	5,786	5,266	+ 9.9	5.0	5.7
American Natural Res.	887,841	813,660	+ 9.1	68,865	62,901	+ 9.5	2,896,008	2,437,686	+ 18.8	154,561	118,236	+ 30.7	5.3	4.9
Arkansas Louisiana Gas	282,333	240,223	+ 17.5	8,386	6,288	+ 33.4	1,179,139	974,510	+ 21.0	87,560	73,427	+ 19.2	7.4	7.5
Columbia Gas	1,351,070	1,057,140	+ 27.8	71,423	57,657	+ 23.9	4,426,243	3,719,921	+ 19.0	190,334	171,346	+ 11.1	4.3	4.6
Consolidated N.G.	810,597	751,748	+ 7.8	37,942	41,446	- 8.5	2,738,164	2,503,054	+ 9.4	131,656	113,008	+ 16.5	4.8	4.5
El Paso Companies	1,128,000	837,000	+ 34.8	39,409	30,534	+ 29.1	3,909,000	3,204,000	+ 22.0	147,257	108,889	+ 35.2	3.8	3.4
Enserch Corp.	853,000	695,000	+ 22.7	43,780	34,807	+ 25.7	3,362,474	2,694,933	+ 24.7	185,513	139,583	+ 34.3	5.5	5.1
Houston N.G.[1]	847,115	653,253	+ 29.7	71,419	54,052	+ 32.1	3,100,172	2,449,754	+ 26.6	255,615	206,848	+ 23.6	8.2	8.4
InterNorth	1,033,220	907,514	+ 13.8	57,417	41,960	+ 36.8	3,655,401	3,037,764	+ 20.3	420,852	209,229	+ 15.1	6.6	6.9
National Fuel Gas	267,766	243,784	+ 9.8	12,308	14,838	- 17.1	912,438	778,439	+ 17.2	27,846	26,970	+ 3.2	3.1	3.5
Northwest Energy	458,151	396,099	+ 15.7	15,823	16,049	- 1.4	1,398,809	1,323,432	+ 5.7	63,767	51,347	+ 24.2	4.6	3.9
Oneok Inc.	353,733	329,143	+ 7.5	15,176	6,808	+ 22.9	1,109,893	943,852	+ 17.6	54,640	42,074	+ 29.9	4.9	4.5
Pacific Lighting	1,006,128	833,075	+ 20.8	18,897	38,017	- 50.3	3,401,489	2,936,937	+ 15.8	117,225	101,129	+ 15.9	3.4	3.4
Panhandle Eastern	803,229	718,143	+ 11.8	48,664	40,588	+ 19.9	3,266,253	2,472,235	+ 32.1	261,604	181,959	+ 43.8	8.0	7.4
Peoples Energy	367,088	287,445	+ 27.7	11,119	9,099	+ 22.2	1,395,259	1,223,434	+ 14.0	29,170	27,952	+ 4.3	2.0	2.3
Pioneer Corp.	317,516	232,053	+ 36.8	25,206	23,962	+ 5.2	1,224,645	911,989	+ 34.3	110,204	90,556	+ 21.7	9.0	9.9
Sonat Inc.	728,047	469,385	+ 55.1	44,643	38,445	+ 16.1	2,629,003	1,798,723	+ 46.2	173,672	147,157	+ 18.0	6.6	8.2
Texas Eastern Corp.	1,242,618	1,155,830	+ 7.5	60,124	58,812	+ 2.2	4,526,114	4,272,854	+ 5.9	224,183	219,757	+ 2.0	5.0	5.1
Texas Gas Trans.	764,851	629,106	+ 21.6	25,981	34,432	- 24.5	2,649,265	2,230,127	+ 18.8	128,684	106,376	+ 21.0	4.9	4.8
Texas Oil & Gas[2]	434,363	344,137	+ 26.2	54,179	40,365	+ 34.2	1,700,749	1,267,187	+ 34.2	205,738	152,222	+ 35.2	12.1	12.0
TransCanada PipeLines	925,455	937,865	- 1.3	42,592	26,339	+ 61.7	3,404,897	3,123,057	+ 9.0	125,573	93,435	+ 34.4	3.7	3.0
Transco Companies	909,446	819,622	+ 11.0	41,286	31,729	+ 30.1	3,525,378	2,627,787	+ 34.2	132,343	112,506	+ 17.6	3.8	4.3
Union Gas Ltd.	279,977	247,056	+ 13.3	8,313	7,974	+ 4.3	934,000	769,103	+ 21.4	22,842	20,462	+ 11.6	2.4	2.6
United Energy Res.	1,507,267	1,113,433	+ 35.4	56,757	48,334	+ 17.4	5,441,604	4,135,342	+ 31.6	215,701	165,454	+ 30.4	4.0	4.0
TOTAL	17,589,074	14,738,781	+ 19.3	881,360	767,025	+ 14.9	62,903,202	51,928,027	+ 21.1	3,472,326	3,685,188	+ 29.3	5.5	5.2

**Excluding non-recurring items. *Earnings available to common stock. [1]Ends October 31. [2]Ends November 30.

FOURTH QUARTER OIL COMPANY FINANCIAL REPORTS

	Three months ending December 31**						Twelve months ending December 31**						Profit Margin	
	Revenues ($000)			Earnings* ($000)			Revenues ($000)			Earnings* ($000)				
Company	1981	1980	% Chg.	1981	1980	% Chg.	1981	1980	% Chg.	1981	1980	% Chg.	1981	1980
Alaska Interstate	100,859	85,977	+ 17.3	8,812	610	+1344.6	360,842	261,652	+ 37.9	41,567	63,141	- 34.2	11.5	24.1
Amarex Inc.	15,059,000	7,030,000	+114.2	1,291,000	720,000	+ 79.3	48,184,000	24,967,000	+ 93.0	4,722,000	2,953,000	+ 60.0	9.8	11.8
Amerada Hess	2,339,424	2,253,822	+ 3.8	48,248	106,603	- 54.7	9,443,630	7,955,490	+ 18.7	212,591	521,642	- 59.2	2.3	6.6
American Petrofina	531,209	616,749	- 13.9	16,989	19,315	- 12.0	2,522,154	2,101,763	+ 20.0	74,140	104,279	- 28.9	2.9	5.0
American Quasar	14,000	12,086	+ 15.8	1,950	148	+1217.6	57,000	44,935	+ 26.8	4,300	4,924	- 12.7	7.5	11.0
Argonaut Energy	2,366	1,047	+126.0	164	96	+ 70.8	5,870[1]	2,648[1]	+121.7	(151)[1]	167[1]			6.3
Argo Petroleum	4,423	4,880	- 9.4	273	1,095	- 75.0	17,811	14,260	+ 24.9	1,867	2,642	- 29.3	10.5	18.5
Ashland Oil	2,409,350	2,030,683	+ 18.6	42,020	14,468	+190.4	9,885,231	8,406,630	+ 17.6	94,592	126,984	- 25.5	1.0	1.5
Atlantic Richfield	7,140,262	7,390,175	- 3.4	469,818	398,279	+ 18.0	28,208,255	24,155,622	+ 16.8	1,671,290	1,651,423	+ 1.2	5.9	6.8
Belco Petroleum	82,333	82,231	+ 0.1	26,366	17,731	+ 48.7	317,098	296,093	+ 7.1	98,350	65,478	+ 50.2	31.0	22.1
Callon Petroleum[2]	3,627	1,898	+ 91.1	327	278	+ 17.6	6,763[3]	4,622[3]	+ 46.3	704[3]	1,625[3]	- 56.7	10.4	35.2
Cities Service	2,226,100	2,090,300	+ 6.5	31,400	117,800	- 73.3	8,659,800	7,577,400	+ 14.6	286,400	488,600	- 41.4	3.3	6.5
Consolidated Oil & Gas	11,699	8,948	+ 30.7	62	348	- 82.2	48,263	33,909	+ 42.3	5,770	1,230	+469.1	11.9	3.6
Crown Central Petr.	412,490	313,748	+ 31.5	14,865	3,868	+284.3	1,487,299	1,266,898	+ 17.4	3,362	19,147	- 82.4	0.2	1.5
Diamond Shamrock	872,548	848,704	+ 2.8	59,733	54,577	+ 9.5	3,376,215	3,145,394	+ 7.3	230,156	213,246	+ 7.9	6.8	6.8
Dyco Petroleum	13,759	10,082	+ 36.5	4,624	2,914	+ 58.7	49,182	32,377	+ 51.9	14,992	8,503	+ 76.3	30.5	26.3
Eagle Exploration	217	252	- 13.9	(122)	35		2,157	2,919	- 26.1	199	40	+501.7	.1	
Exxon	29,583,000	29,759,000	- 0.6	1,065,000	1,340,000	- 20.5	114,989,000	110,381,000	+ 4.2	5,565,000	5,650,000	- 1.5	4.8	5.1
Freeport McMoRan	199,754	190,322	+ 5.0	30,567	38,475	- 20.6	835,404	701,552	+ 19.1	158,972	161,870	1.8	19.0	23.1
General American	85,645	75,765	+ 13.0	18,557	10,499	+ 76.7	354,016	273,448	+ 29.5	59,680	54,131	+ 10.3	16.9	19.8
Getty Oil	3,472,840	2,966,250	+ 17.1	216,503	211,103	+ 2.6	13,251,560	10,436,827	+ 27.0	856,865	871,866	- 1.7	6.5	8.4
Gulf Energy & Develop.	17,652	18,685	- 5.5	2,821	1,829	+ 54.2	60,132	50,486	+ 19.1	7,407	6,088	+ 21.7	12.3	12.1
Gulf Oil Corp.	7,957,000	7,621,000	+ 4.4	301,000	304,000	- 1.0	30,461,000	28,808,000	+ 5.7	1,231,000	1,407,000	- 12.5	4.0	4.9
Helmerich & Payne	95,779	66,217	+ 44.6	23,196	15,398	+ 50.6	343,402	230,903	+ 48.7	83,057	52,167	+ 59.2	24.1	22.5
Holly Corp.[4]	129,794	99,939	+ 29.9	5,398	1,675	+222.3	419,438	410,540	+ 2.2	5,672	9,181	- 38.2	1.4	2.2
Inexco Oil	62,621	39,220	+ 59.7	9,596	5,190	+ 84.9	238,738	146,606	+ 62.8	31,921	22,576	+ 41.4	13.4	15.4
KEBA Oil & Gas[2]	162	153	+ 5.8	(8)	22		927	452	+105.1	140	14	+900.0	15.1	3.1
Kerr-McGee Corp.	1,072,719	949,371	+ 13.0	65,999	51,791	+ 27.4	3,826,420	3,477,881	+ 10.0	211,117	182,223	+ 15.9	5.5	5.2
Louisiana L&E	342,791	305,100	+ 12.4	18,533	48,227	- 61.6	1,227,539	1,075,771	+ 14.1	145,229	180,162	- 19.4	11.8	16.7
Mapco Inc.	585,671	532,864	+ 9.7	31,114	28,969	+ 7.4	2,182,463	1,769,740	+ 23.3	96,890	122,260	- 20.8	4.4	6.9
Marathon Oil	2,637,157	2,420,748	+ 8.9	40,054	55,273	- 27.5	9,814,665	8,754,198	+ 12.1	343,059	379,016	- 9.5	3.5	4.3
Marion Corp.	104,920	137,986	- 24.0	(2,142)	7,317		455,342	470,266	- 3.6	1,607	22,420	- 92.8	0.4	4.8
Mesa Petroleum	99,398	86,747	+ 14.6	28,120	33,979	- 17.2	407,744	372,363	+ 9.5	106,379	95,236	+ 11.7	26.1	25.6
Mobil Corp.	18,024,000	17,388,000	+ 3.7	588,000	558,000	+ 5.4	68,516,000	63,726,000	+ 7.5	2,434,000	2,813,000	- 13.5	3.6	4.4
Moran Energy	26,128	19,968	+ 30.8	4,818	3,857	+ 24.9	100,499	67,123	+ 49.7	19,545	12,187	+ 60.4	19.4	18.2
Murphy Oil	702,534	538,239	+ 30.5	41,396	45,610	- 9.2	2,561,228	2,017,937	+ 26.9	165,944	150,547	+ 10.2	6.5	7.5
Natomas	441,359	333,559	+ 32.3	48,807	44,083	+ 10.7	1,582,396	1,286,104	+ 23.0	232,527	208,370	+ 11.6	14.7	16.2
Noble Affiliates	106,166	71,246	+ 49.0	21,972	13,092	+ 67.8	388,918	276,561	+ 40.6	80,281	47,199	+ 70.1	20.6	17.7
Occidental Petroleum	4,469,354	3,179,605	+ 40.6	164,636	131,153	+ 25.5	14,707,543	12,476,125	+ 17.9	673,051	680,071	- 1.0	4.6	5.5
Oxoco	12,723	3,424	+271.6	2,768	157	+1163.1	28,340	11,917	+137.8	5,564	1,539	+261.5	19.6	12.9
Patrick Petroleum[5]	41,742	16,839	+147.9	4,031	1,359	+196.6	65,655[3]	29,061[3]	+125.9	5,897[3]	1,586[3]	+271.8	9.0	5.5
Patton Oil	724,726	614,495	+ 17.9	(73,939)	(21,716)		3,421,085	3,110,389	+ 10.0	326,780	684,648	- 52.2	9.6	22.0
Pennzoil Co.	652,982	659,422	- 1.0	53,702	76,384	- 29.7	2,681,751	2,483,015	+ 8.0	217,251	304,076	- 28.6	8.1	12.2
Petro-Lewis	53,829	46,314	+ 16.2	5,175	9,045	- 42.8	110,170[3]	87,065[3]	+ 26.5	12,248[3]	17,238[3]	- 29.0	11.1	19.8
Phillips Petroleum	4,091,181	3,874,418	+ 5.6	186,526	286,973	- 35.0	16,287,753	13,712,879	+ 18.8	879,364	1,069,614	- 17.9	5.4	7.8
Prairie Producing	7,470	6,510	+ 14.7	1,200	882	+ 36.0	30,405	21,927	+ 38.7	3,920	4,256	- 7.9	12.9	19.4
Quaker State	229,177	222,065	+ 3.2	6,747	5,463	+ 23.5	918,913	832,492	+ 10.4	27,363	25,775	+ 6.2	3.0	3.1
Sabine Corp.	46,749	34,740	+ 34.5	5,628	7,008	- 19.6	172,670	124,114	+ 39.1	28,342	25,142	+ 12.7	16.4	20.2
Shell Oil	5,193,000	5,130,000	+ 12.3	458,000	409,000	+ 11.9	21,739,000	19,959,000	+ 8.9	1,701,000	1,542,000	+ 10.3	7.8	7.7
Southland Royalty	99,054	89,491	+ 10.7	9,368	9,924	- 5.6	400,139	366,571	+ 9.2	36,689	62,289	- 41.1	9.2	17.0
Southwestern Energy	13,315	12,712	+ 4.7	2,286	2,798	- 18.3	54,756	47,959	+ 14.2	11,856	10,253	+ 15.6	21.7	21.4
Standard California	11,900,000	10,800,000	+ 10.2	571,000	615,000	- 7.2	45,200,000	41,600,000	+ 8.7	2,380,000	2,400,000	- 0.8	5.3	5.8
Standard Indiana	7,730,000	7,697,000	+ 1.1	336,000	366,000	- 8.2	31,613,000	27,832,000	+ 13.6	1,771,000	1,841,000	- 3.8	5.6	6,6
Standard Ohio	3,704,400	3,062,600		477,800	475,800		13,810,900	11,345,600		1,946,900	1,811,200			
Sun Co.	4,400,000	4,100,000	+ 7.3	448,000	30,000	+1393.3	16,000,000	13,200,000	+ 21.2	1,076,000	723,000	+ 49.0	6.7	5.5
Superior Oil	560,547	440,720	+ 27.2	73,225	97,203	- 24.7	2,057,419	1,497,695	+ 37.4	361,291	334,458	+ 8.0	17.6	22.3
Supron Energy	19,913	19,979	- 0.3	5,242	6,406	- 18.2	77,986	66,266	+ 17.7	20,663	20,093	+ 2.8	26.5	30.3
Tenneco	4,292,000	3,641,000	+ 17.9	260,000	200,000	+ 30.0	15,462,000	13,226,000	+ 16.9	813,000	726,000	+ 12.0	5.3	5.5
Tesoro	660,820	865,700	- 23.7	20,811	21,102	- 1.4	2,864,690	3,421,862	- 16.3	73,100	84,200	- 13.2	2.6	2.5
Texaco	14,700,000	14,100,000	+ 4.1	507,000	500,000	+ 1.2	59,400,000	52,500,000	+ 13.1	2,310,000	2,240,000	+ 3.1	3.9	4.3
Tribune Oil	470	339	+ 38.6	200	121	+ 65.3	2,260	1,722	+ 31.2	745	583	+ 27.8	33.0	33.9
Union California	2,911,200	2,693,800	+ 8.1	236,000	177,200	+ 33.2	11,296,200	10,472,500	+ 7.9	791,400	647,000	+ 22.3	7.0	6.2
Universal Resources[5]	17,282	11,401	+ 51.6	3,679	2,352	+ 56.4	63,707	38,899	+ 63.7	13,601	7,222	+ 88.3	21.3	18.6
Vanderbilt Energy	2,050	1,612	+ 27.2	45	180	- 75.0	5,688	4,193	+ 35.7	318	648	- 50.9	5.6	15.5
Wainoco Oil	11,862	10,431	+ 13.7	(1,362)	1,967		44,554	36,009	+ 23.7	(3,674)	7,051			19.6
Westcoast Petroleum	10,875	8,336	+ 30.5	2,316	2,507	- 7.6	38,587	33,220	+ 16.2	6,729	8,841	- 23.9	17.4	26.6
Wiser Oil	14,737	17,074	- 13.7	4,690	6,715	- 30.2	62,516	61,028	+ 2.4	17,824	18,240	- 2.3	28.5	29.9
Woods Petroleum	22,900	15,063	+ 52.0	8,632	4,474	+ 92.9	71,969	53,983	+ 33.3	21,897	14,893	+ 47.0	30.4	27.6
TOTAL	163,615,123	147,777,051	+ 10.7	8,355,196	7,702,011	+ 8.5	,633,326,417	545,767,261	+ 16.0	34,835,618	33,986,500	+ 2.5	5.5	6.2

**Excluding non-recurring items. *Earnings available to common stock. ()Loss. [1]Nine months. [2]Ends November 30. [3]Six months. [4]Ends July 31.
[5]Ends October 31.

performance from chemical operations during the first nine months increased earnings from $54.5 million to $59.7 million.

Vanderbilt Energy's 75 percent drop in income was due primarily to higher exploration costs, windfall profits taxes and high interest rates.

Higher interest rates due to higher outstanding debts from drilling activities and property acquisitions drove Petro-Lewis' earnings down 43 percent.

Moran Energy's 24 percent increase is attributed to increased production of oil and natural gas, higher natural gas prices, maximum drilling rig utilization and increased contract drilling margins.

An increase in oil, gas and equipment sales accounted for most of Argonout Energy's 71 percent rise in net income.

Of the 24 gas companies responding to our survey, 79 percent reported an increase in net earnings. Overall, the group's net income rose 15 percent in the fourth quarter.

Peoples Energy earnings rose 22 percent due to a recent rate increase and colder weather.

Higher oil, natural gas and natural gas liquids production as well as higher average selling prices accounted for Enserch's increase in net income from $34.8 million to $43.8 million.

El Paso Company's 29 percent increase is a result of higher profits from gas and oil production as well as increased earnings from interstate gas transmission activities and natural gas liquids operations.

Warmer weather, absence of LNG earnings and the recession combined to cause Consolidated Natural Gas earnings to drop to $39 million from $42.8 million.

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Liquids/Slurry Pipelines Report

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Sheep Mountain CO_2 Pipeline Involves Extensive Design Effort 61

ARCO will build a 405-mile pipeline to bring CO_2 from Colorado to West Texas for use in enhanced oil recovery projects. Design process is underway.

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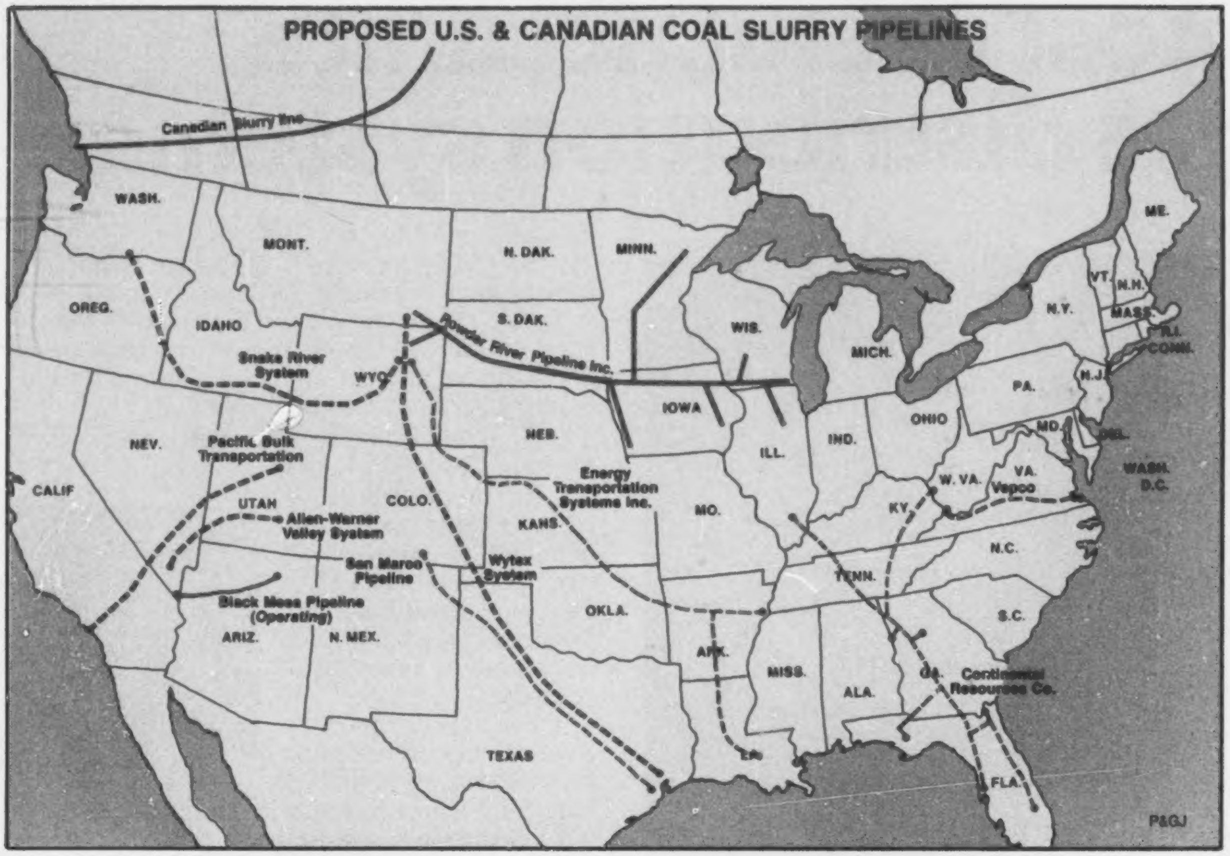
COVER

Oil and its products account for nearly 60% of U.S. energy requirements . . . and nearly all of it moves through liquids pipelines at some time or another.

– photo courtesy Williams Brothers Pipe Line Co.



PROPOSED U.S. & CANADIAN COAL SLURRY PIPELINES

Canadian Slurry line
WASH.
MONT.
OREG.
IDAHO
Snake River System
WYO.
N. DAK.
MINN.
S. DAK.
Powder River Pipeline Inc.
WIS.
MICH.
N.Y.
VT.
N.H.
ME.
MASS.
R.I.
CONN.
N.J.
PA.
IOWA
NEB.
OHIO
IND.
ILL.
MD.
DEL.
NEV.
Pacific Bulk Transportation
CALIF
UTAH
COLO.
Energy Transportation Systems Inc.
KANS.
MO.
W. VA.
VA.
Vepco
WASH. D.C.
KY.
Allen-Warner Valley System
San Marco Pipeline
Wytex System
N.C.
TENN.
Black Mesa Pipeline (Operating)
ARIZ.
N. MEX.
OKLA.
ARK.
S.C.
MISS.
ALA.
GA.
Continental Resources Co.
LA.
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Legislative Moves Will Help Slurry Pipeline Project Prospects

by **Dean Hale,** *Editor*

Activity in the coal slurry pipeline area continues to grow as proponents of slurry pipeline transportation and ultimate users of the transportation services that slurry lines would provide push to get vitally needed projects underway.

Much of that push revolves around two major concerns where favorable legislation is needed – the right of eminent domain via federal legislation (giving coal slurry pipelines the same right of eminent domain as that granted to natural gas pipelines) and rights to obtain water supplies that are fair and equitable.

Two bills continue to move, albeit slowly, in the Congress. In the Senate, in early May, hearings were held by the Energy and Natural Resources Committee, whose chairman is Sen. James McClure (R-Idaho), on S.1844 – the Coal Distribution and Utilization Act. Additional hearings will be held in early June by the same committee on the water issues related to the bill.

In the House of Representatives, H. R. 4230, the Coal Pipeline Act, has been passed by the Surface Transportation Subcommittee of the Public Works Committee and is presently waiting on an actual vote by the full Public Works Committee, which is chaired by Rep. Jim Howard (D-N.J.).

Both bills are the targets of incessant lobbying by railroad interests that are opposed to competitive forms of transport. Slurry pipeline proponents are quick to point out that recent railroad deregulation and large mergers and proposed mergers are eliminating most of the rail competition in the U.S. – and without competition, there is little effective price moderation available on transportation costs.

Both bills before the Congress include very protective language to protect the water rights of the various states and reserve questions of water rights and access to water to the states.

The Slurry Transport Association, in its educational programs, continues to emphasize that there will be much more emphasis in the future on coal production and utilization and export of coal, and that there must be greater awareness of the need for competition in the coal transportation area.

Currently, there are 10 coal slurry pipeline projects proposed for the U.S. plus one project in Canada, and these total 10,896 miles of pipelines. The planned, proposed, and under-study lines are detailed in the accompanying table.

Energy Transportation System, Inc. has reached some major goals in the past year, with a major achievement being the signing of an agreement with the state of South Dakota for the purchase of 50,000 acre-feet of water from the Oahe Reservoir in South Dakota. The agreement, effectively, assures a secure 50-year water supply for the life of the ETSI coal slurry pipeline project.

To take water from Oahe Reservoir near Pierre, S. Dak., to ETSI's coal slurry preparation plant near Gillette, Wyo. will require a 267-mile water pipeline that will also supply water to communities and rural water districts in western South Dakota. ETSI will transport 4300 acre-feet of water each year free of charge to those communities and districts. It will also provide up to $200,000 in technical assistance on water supply problems to other western South Dakota communities.

A final environmental impact study conducted under the leadership of the

U.S. & Canadian Coal Slurry Pipelines

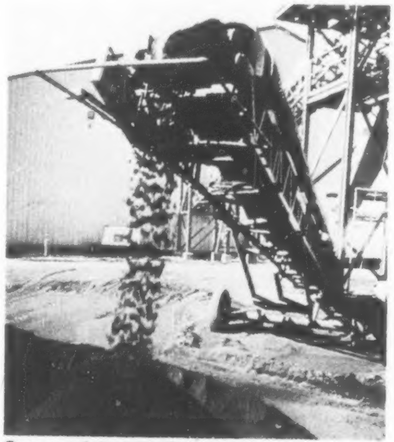
Company	Miles	Sizes (In.)	From	To	Estimated Cost ($Millions)	Status	Contractor or Engineering Co.	Annual Tonnage (Millions)
Alberta Economic Development, Energy & Natural Resources Ministries	500	Unk.	Hinton, Alberta	West Coast Port	–	Planned	Fluor (E)	N.A.
Allen-Warner Valley Energy Systems (Nevada Power Co.)	183	20, 22	Alton, Utah	Allen Station	$270	Planned	Engineering Management, Inc. (E)	9.1
	73	9, 12	Alton, Utah	Warner Valley, Utah	–	Planned		2.5
Coalstream Pipeline Co. (Continental Resources Inc.)	1500	24-48	Kentucky	Florida	$3000	Planned	Fluor (E)	55
Energy Transportation Systems Inc.	1387	38	Wyoming	Baton Rouge, La.	$2000	Planned	Bechtel (E)	37
Pacific Bulk Transportation Systems (Boeing Engineering & Construction Co.)	650		Emory, Carbon counties, Utah	Oxnard, Calif.	$500	Planned	Boeing (E)	10
Powder River Pipeline Inc.	1923	42	S. E. Montana	Great Lakes areas, other terminals	$2500	Planned	–	36
San Marco Pipeline Co. (Houston Natural Gas, Rio Grande Industries)	900	20, 24	S. E. Colorado	Texas Gulf Coast	$800	Planned	–	15
Snake River System (N.W. Energy, Gulf Interstate)	1100	20, 24	N. E. Wyoming	Idaho, Oregon	$500	Planned	–	10
Tesoro Petroleum Corp.	1000	30	Kentucky	Southeastern U.S.	$1000	Planned	–	N.A.
Virginia Electric Power Co.	420	12-36	Proud, W.V.	Portsmouth, Va.	$250	Planned	–	10
Wytex System (Texas Eastern, Brown & Root)	1260	36, 40	Powder River basin, Wyo.	Houston area	$1800	Planned	Brown & Root (E)	22

Bureau of Land Management was produced and provided a very positive assessment of the ETSI system. It found coal slurry pipelines to be a safe means of transportation that has little effect on the environment and said coal slurry pipelines cause the lease possible risk to public safety of all coal transportation alternatives.

ETSI's coal evaluation plant, in operation at White Bluff, Arkansas since November 1981, has confirmed that the design basis for the ETSI line is sound. Grinding mills produced pipeline slurry using Powder River Basin coal with minimum dust emission by use of a wet collection system after the cage mills. At the dewatering end, ETSI's tests confirmed the estimate that the primary dewatering centrifuge would produce about 40 tons of dry coal per hour. Water clarity was excellent and the water from the process will meet federal and state water purity standards before the slurry water is released to public streams.

ETSI plans to route the pipeline through the northeast corner of Colorado. After serving power stations in Oklahoma, the pipeline will head east into Arkansas and split into two branches near Little Rock. One branch will terminate at Independence and the southerly branch will end at Cypress Bend on the Mississippi River, where a barge loading terminal will be built to permit shipping of dewatered coal to powerplants in Louisiana.

ETSI's construction schedule is "on schedule." A basic engineering design has been completed. Construction is expected to begin in 1983 so that the first phase of the line can be completed and initial coal deliveries begun in 1985. The line is expected to be in full operation in 1986.



Successful operation of the coal evaluation plant at White Bluff, Ark. was recent highlight of operations reported by Energy Transportation System, Inc., which plans to build a 1387-mile coal slurry pipeline from Wyoming to Arkansas and Louisiana.

Nevada Power Co.'s Allen-Warner Valley Energy System has undergone some major changes and revisions. The Alton coal slurry pipeline is one of five major components of the energy system, and has the approval of the Secretary of Interior for pipeline right-of-way in Utah, Arizona, and Nevada. The line is being designed by Engineering Management, Inc., under direction of Black Mesa Pipeline. EMI currently is conducting preliminary engineering and environmental studies.

Two separate lines are planned to meet changed conditions. The Allen Station line will have 164 miles of 22-in. and 19 miles of 20-in. pipeline, capable of delivery of 9.1 million tons annually to the Allen Station near Las Vegas, Nev. The Warner Valley Station line will have 68 miles of 12-in. (that will parallel the 22-in. line) and 5 miles of 9-in. line, capable of delivering 2.5 million tons per year to the Warner Valley Station.

Powder River Pipeline Co., Inc. has a four-phase project underway. Phase I includes a feasibility study that is to be completed by July 1982. Phase II will involve the addition of other participants to the project and is to be completed by early 1985. Construction will be initiated in Phase III and is to be completed by 1987 at a cost of $2.5 billion. Phase IV involves operation in 1986.

Virginia Electric Power Co. has completed studies on four alternative routes ranging from 400 to 465 miles in length, and involving pipe sizes from 19 to 43-in. diameter and a system having six or seven pumping stations on the line. Throughputs would range from 5 to 25 million tons per year.

Vepco says the studies indicate, initially, that coal slurry pipelines should be feasible in moving its coal requirements from mines to power plant sites.

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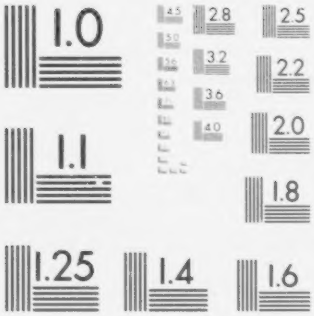
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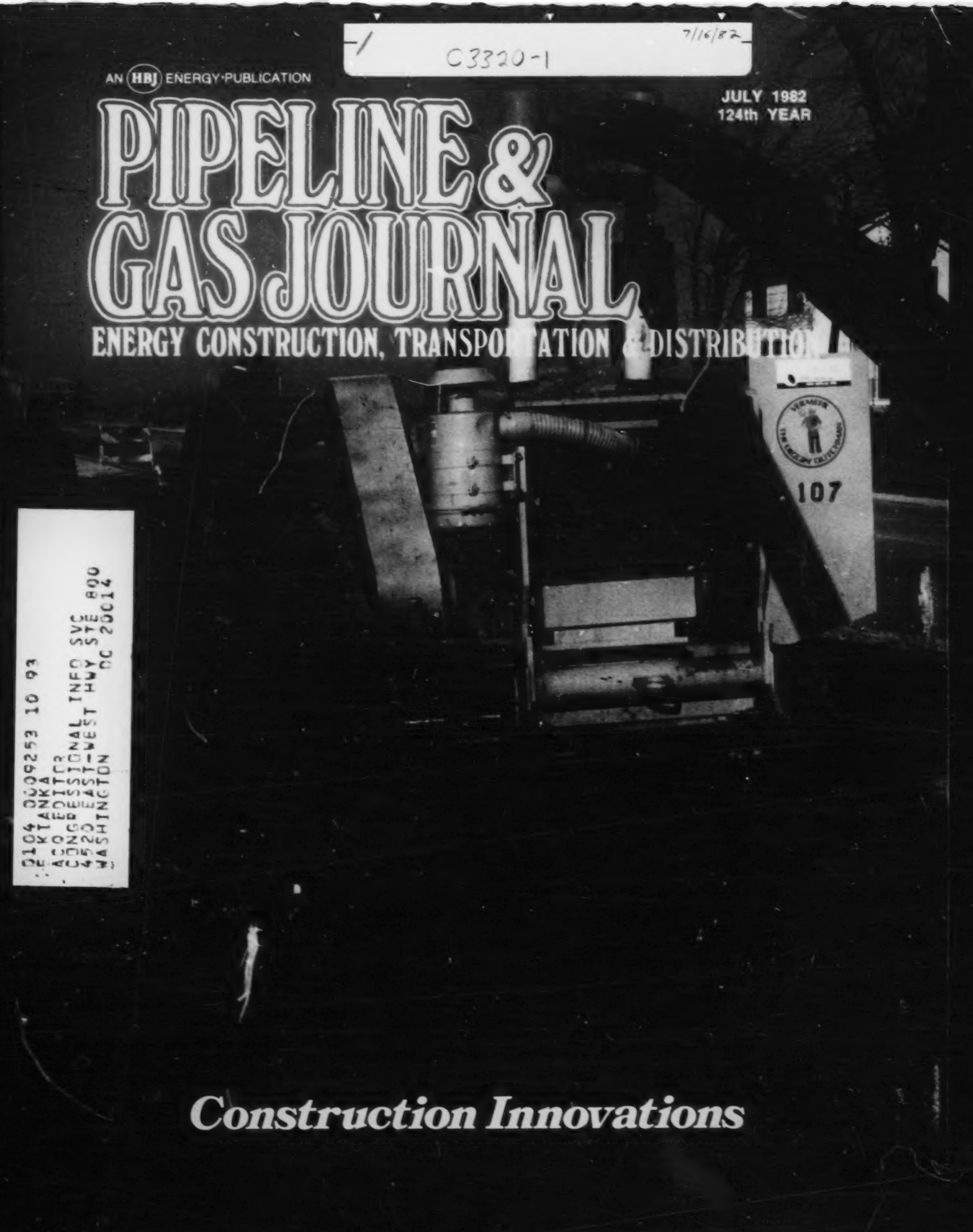

Construction Innovations

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COVER
"Planting" pipe along the banks of the Mississippi River in Illinois, between Savanna and Thomson, Illinois, contractor crews laid out long strings of 8-in. HDPE pipe ahead of the trencher; pipe was reeled over trencher and directly into ditch.

–photo courtesy Plexco

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Many new ways to build better pipelines and gas distribution systems – and do it faster and more efficiently – these are the "innovations" that help to get pipe in the ground quicker and P&GJ takes a look at the crop of the past 12 months.

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On the eastern banks of the Mississippi between Thomson and Savanna, Ill., a new 9.5-mile, 8-in. feeder line was "planted" in rapid time. Method employed field fusion-joining in long sections ahead of trencher, running pipe up and over trencher and lowering-in directly through a unique "sandbox" that hastened backfill.

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Gas industry's pavilion at the 1982 World's Fair in Knoxville is an eye-catching blue and silver, multi-pyramid-shaped space-frame structure housing a unique gas industry exhibit – 3000 sq ft of displays covering all facets of the gas business and its products.

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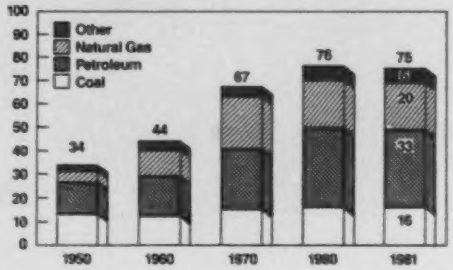
National Crime Information Center computer is being used by law enforcement agencies to help find stolen property; contractors reporting stolen property must do it in a very specific fashion to get this help in finding and recovering their property.

Energy Supply Forecast

United States Energy Consumption
Consumption—Quadrillion Btu



— *Source: A.G.A. Gas Supply Committee*

Sources Of Natural Gas

Currently Commercial

- Lower 48
- Alaska
- Canada
- Mexico
- Tight Sands
- Devonian Shale
- LNG Imports
- SNG From Liquids
- Urban Waste

Not Yet Commercial

- Coal Gasification
  - — High Btu
  - — Medium Btu
- Peat Gasification
- Oil Shale Gasification
- Geopressured Aquifers
- Biomass
- Coal Seams

— *Source: A.G.A. Gas Supply Committee*

Supply To 2000: We'll Need Supplemental Gas Supplies

by **W. J. Bowen,** *Chairman and Chief Executive Officer,*

Transco Companies, Houston, Texas

What's the outlook for gas energy for the remainder of this century? The answer quite possibly may be found in a major study completed by the American Gas Association's Gas Supply Committee - underway for three years - and possibly the most comprehensive and broadly-based supply estimate ever developed by the gas industry.

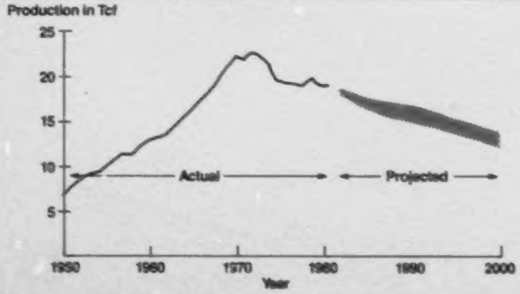
Most experts estimate that U.S. energy consumption by 2000 will be between 90 and 110 quadrillion Btu's. This represents a nominal increase of about 25 quads and, if oil imports are to be reduced, our energy needs will require significant increases in all available domestic energy sources. That includes supplemental sources of gas - both conventional and nonconventional.

Today, the U.S. uses 75 quads of energy. The natural gas share is approximately 27%. If a 25% market share is maintained throughout this century, the 100 quad level would imply that, by 2000, some 25 quads of energy will be needed from natural gas.

In the Lower 48 states, reserves have been declining since

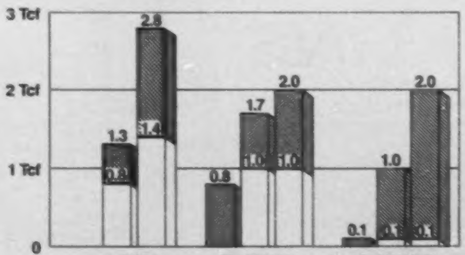
— *Source: A.G.A. Gas Supply Committee*

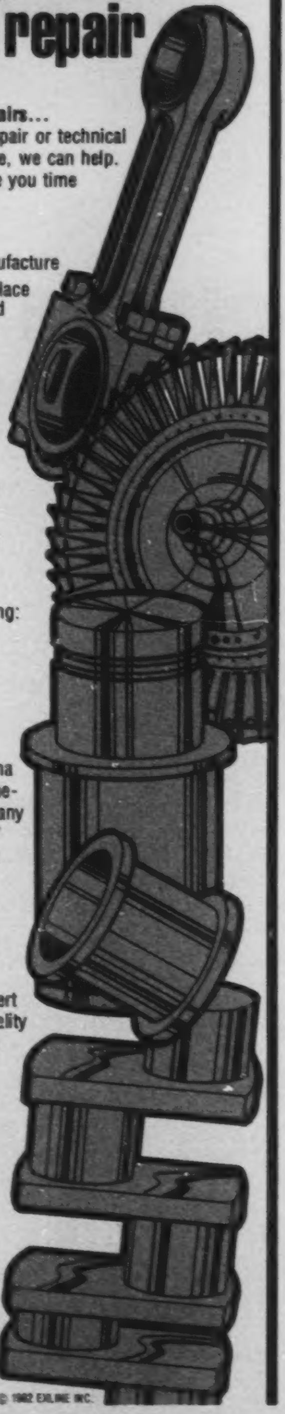
Lower 48 Conventional
Natural Gas Production



— *Source: A.G.A. Gas Supply Committee*

Estimated Alaskan, Canadian,
And Mexican Gas Supplies (Tcf)





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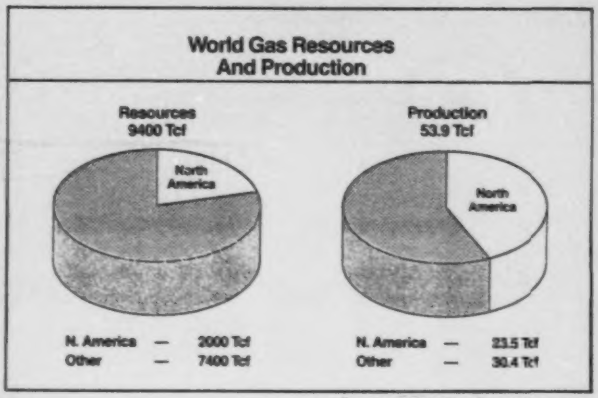


— *Source: A.G.A. Gas Supply Committee*

1967 because production has exceeded additions to reserves each year. This led to a production problem. Production peaked in 1972 and declined thereafter because of the decline in reserves.

Response to that decline was that gas prices began to rise. This increased drilling activity. Gas well completions began rising sharply in 1972 and a new record was set in 1973. New national records for gas well completions have been set each year since.

In contrast to sharply rising gas well completions, Lower 48 reserve additions generally declined from 1967 through 1977. Most of this was due to controlled wellhead prices.

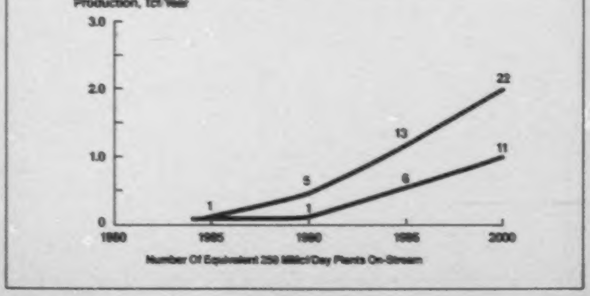
Analysis at A.G.A. has demonstrated that, prior to passage of the Natural Gas Policy Act of 1978 (NGPA), approximately 90% of the gas wells were completed in regions thought to contain only 30% of the gas. To correct this trend, the NGPA created new pricing incentives for the Outer Continental Shelf, for deep gas, and for particular areas in the shallow Lower 48 where drilling activity was not strong because of high drilling costs. Those incentives, intended to encourage development of gas in more difficult areas, have produced positive results.

Even with strong price incentives and record drilling activity, production from the Lower 48 is expected to decrease between 1982 and 2000. Supplemental sources are needed to offset this decline.

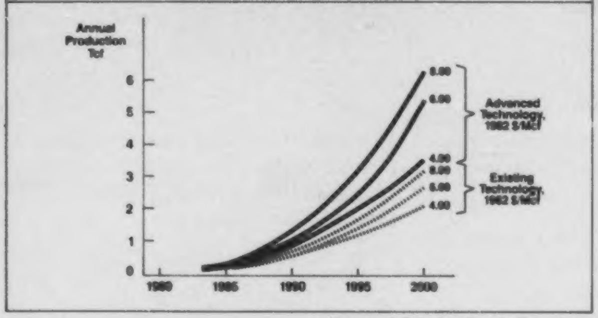
Supplemental Sources

Of the supplemental sources of gas, three available from the North American continent are gas from Alaska, gas from Canada, and gas from Mexico. Production levels of 0.2 Tcf from Alaska, 2.5 Tcf from Canada, and 1.5 Tcf from Mexico are

— *Source: A.G.A. Gas Supply Committee*



Potential Impact Of Technology On Tight Gas Sands Production



— *Source: A.G.A. Gas Supply Committee*

Gas Supply Scenarios

Scenario	Emphasis	Restriction
Self Sufficiency	Alaskan, Coal Gas, R&D	Imports
North American Focus	Alaskan, Canadian, Mexican, Coal Gas, R&D	LNG
Moderate Imports	Canadian, Mexican, LNG	Moderate R&D
World Conventional Gas	All Conventional Natural Gas Sources	SNG, Moderate R&D

— *Source: A.G.A. Gas Supply Committee*

all quite small compared to the 19.3 Tcf of the Lower 48 states.

If the reserves are taken into account, the reserves-to-production ratio (R/P) is a good measure of how vigorously reserves are being produced. A low R/P ratio means reserves are being produced rapidly; a high R/P ratio means production rate is low. Production could be increased in any one of these three areas by a factor of two or three and they would still have a very respectable R/P ratio compared to the Lower 48 states.

By the year 2000, between 1.4 and 2.8 Tcf of gas could be available annually from Alaska. Canada has a capability to increase exports from the current 1 Tcf per year to 2 Tcf per year by 2000. Mexico is capable of increasing gas exports significantly to the 2 Tcf per year level. However, political considerations could cause Mexico to maintain the level near what has been presently approved (300 MMcf per day, equal to 0.1 Tcf per year).

Clearly, pipeline sources for North America are a secure, reliable, and major source of natural gas for the future.

World Gas Resources

World resources of natural gas are very large – 9400 Tcf. About 7400 Tcf is outside of North America, but is a resource that could be the basis for future LNG imports. World gas production (excluding North America) was only 30.4 Tcf in 1980. North America in 1980 produced 23.51 Tcf, about 44% of the world's gas while having only 27% of the world's resources.

There is a tremendous capability for an increase in world production of gas. If it could be increased to the intensity of the Lower 48 states, natural gas would be available that would surpass the capability of local markets to consume that gas.

Under such circumstances, many countries could be in a position to export this gas in large quantities by either liquefying it and shipping it in LNG tankers, or by building pipelines to connect production to points of consumption. A large capital investment would be required to do this – and that could be a major restraint to the growth of world LNG trade.

Five import terminals have been approved for LNG in the U.S. and all but the one in California have been constructed. Rejuvenation of U.S. LNG imports will permit fuller utilization of these facilities. We envision an eventual vigorous world trade in LNG – and assume that the U.S. will be a major participant in this trade.

Coal Gasification

High Btu pipeline gas can be produced from the very large fossil fuel resources in the U.S. that represent between 28,000 and 45,000 quadrillion Btu's. This is recoverable energy. Coal is our most plentiful energy resource – about three-fourths of our remaining fossil fuel energy.

One major energy policy goal is to develop environmentally acceptable and economically attractive ways to use this coal. One such use is coal gasification. Current technology permits the gasification of coal using the Lurgi process, followed by a methanation step to produce high Btu gas. The first U.S. operational plant will be the Great Plains project in North Dakota. This plant is expected to begin producing high Btu gas in 1984.

If the plant is environmentally and economically successful (and if the government provides financial and regulatory support to encourage construction of other plants), by 2000 there could be as many as 20 plants producing over 2.0 Tcf per year.

On the other hand, if government support for such future projects is not positive, as few as 10 plants might be built by

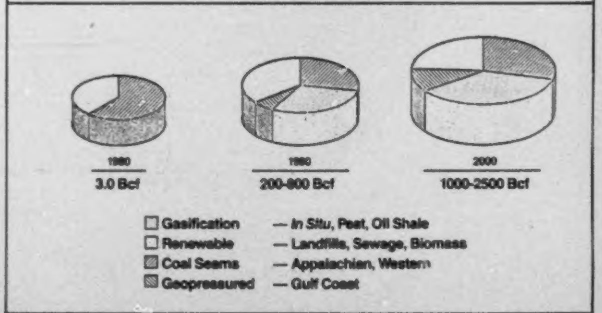
— *Source: A.G.A. Gas Supply Committee*

Gas Supply Estimates For Year 2000

	Tcf
Conventional Lower 48 States	12–14
Alaskan	1.4–2.8
Canadian	1.0–2.0
Mexican	0.1–2.0
LNG Imports	0.7–2.5
Coal Gas (High, Medium, Low)	1.3–2.7
Tight Formations	1.2–3.0
SNG From Liquid Hydrocarbons	0.1–0.5
Nonconventional	1.0–2.5

— *Source: A.G.A. Gas Supply Committee*

Potential Nonconventional Gas Production



Gas Supply Scenarios in Year 2000 (Tcf)

	Self Sufficiency	North American Focus	Moderate World Imports	World Conventional Gas Emphasis
Lower 48	13 – 14	12 – 14	12 – 14	12 – 14
SNG From Liquid Hydrocarbons	0.3	0.3	0.3	0.1
Alaskan	2.8	2.8	1.4	2.8
Canadian	1.0	2.0	2.0	2.0
Mexican	0.1	2.0	2.0	2.0
LNG Imports	0.7	0.7	1.5	2.5
Coal Gas	2.7	2.7	1.3 – 2.5	1.3 – 2.5
Tight Formations	1.2 – 3.0	1.2 – 3.0	1.2 – 3.0	1.2 – 3.0
Nonconventional	1.0 – 2.5	1.0 – 2.5	1.0 – 2.5	1.0 – 2.5
Total	22.8 – 27.1	24.7 – 30.0	22.7 – 29.2	24.9 – 31.4

— Source: A.G.A. Gas Supply Committee

2000 with a production level of slightly more than 1.0 Tcf per year. The major buildup of production capability is 10 to 15 years in the future, but these large quantities of domestically produced gas provide an attractive energy option.

Another extremely attractive source of natural gas is tight reservoir formations. Two dominant sources of tight formation gas are tight gas sands, mostly in the Rocky Mountain states, and Devonian shale gas, mostly in the Appalachian states. Volume of gas recoverable from these formations depends largely on the price of the gas and technology available to produce it. At $8 per Mcf in 1982 dollars and with advanced technology, production in 2000 from tight gas could be three times greater than it is today at $4 per Mcf with existing technology.

Production levels from 2 to 6 Tcf per year might be possible. These curves underscore the importance of a vigorous R&D program that will allow the advance technology case to be realized.

Some of the most exciting future supplies of gas are expected to come from the nonconventional gas sources. Already, gas produced from coal seams and landfills is commercial. Other sources – such as gasification of peat and oil shale, or from sewage and biomass, and geopressured gas – are not expected to be commercially productive until the 1990s. In 1980, 3 Bcf came from coal seams and landfills; in addition to this gas, by 1990 gasification and even some pressurized gas might contribute to the 200 to 800 Bcf of gas produced. By 2000, supplies could be as much as 2.5 Tcf. That would still be less than 10% of total gas supply.

Examining Future Probabilities

To facilitate combining various source estimates into a meaningful overall estimate, four national policy scenarios were developed by the committee. The scenarios are simply options that serve to illustrate how gas supplies from different sources change in response to federal policies.

— Source: A.G.A. Gas Supply Committee

Summary

- Conventional lower 48: 12 – 14 Tcf by 2000.
- Supplementals will enable gas supplies to increase.
- Gas energy could supply 31 Tcf by 2000
  - – Federal support to reduce oil imports, emphasizing gas R&D.
  - – Climate conducive to capital investment.
  - – Competitive gas prices after decontrol.

A self sufficiency scenario assumes that federal policies encourage all domestic gas sources and discourage any imports.

A North American Focus scenario is based on a similar concept of emphasizing secure sources of gas supply except that Canadian and Mexican sources are encouraged. Any North American gas source is encouraged. LNG imports are restricted.

The **Moderate World Imports** scenario would permit some limited amounts of increased LNG trade. Restrictions would be placed on such imports so that they would not unduly affect domestic gas supply.

The final scenario, **World Conventional Gas Emphasis,** envisions a world in which gas resources are being vigorously developed everywhere. As a result, large amounts of natural gas are available in many parts of the world for international trade. As might be expected, cheap and available imports would undercut domestic R&D programs and would limit some domestic gas sources.

Clearly, the greater the restrictions, the less supply available. Interestingly, the low values are generally between 23 and 25 Tcf; high values are between 27 and 32 Tcf. The overall view of the scenarios demonstrates a consistency of results.

In the year 2000, our gas supply should exceed 23 to 25 Tcf, but will not be more than 27 to 32 Tcf.

In terms of the original speculation about a total energy demand of 100 quads in 2000, if gas provides a market share of 25%, supplies of 25 Tcf are needed. If gas' share rises to a 30% level, a supply of about 30 Tcf will be needed. That is consistent with the upper limits of the scenarios.

In summary, our estimate is that conventional Lower 48 well production will decrease from the current level of about 19 Tcf to between 12 and 14 Tcf in 2000. Today, the Lower 48 provides over 90% of the U.S. gas supply. By 2000, the Lower 48 will provide about half. To continue to provide reliable gas service to our customers, supplemental sources will be essential. The leve of future gas prices will be very important in this supply picture.

The major uncertainties in these estimates, of course, are those associated with future federal and regulatory policy decisions. Technological uncertainties are also a factor, but timely R&D investment can reduce this uncertainty to acceptable limits.

Finally, the analysis concludes that a vigorous program to develop a wide range of gas energy sources ("The Gas Option") is highly desirable and achievable.

About The Author

W. J. "Jack" Bowen *is chairman and chief executive officer of Transco Companies Inc., a diversified energy company headquartered in Houston, Tex., with two principal subsidiaries. Transcontinental Gas Pipe Line Corp. operates one of the nation's largest gas pipeline systems from the Gulf Coast to markets in 11 Southeast and East Coast states. Transco Exploration Co. is active in oil and gas exploration and production in the Gulf Coast area. Bowen, a native of Texas, is a graduate of the U.S. Military Academy at West Point. He began his oil and gas career in 1949 with Delhi Oil Co. in Dallas and while there was instrumental in organizing a gas pipeline project to Florida. In 1960 he was named chief executive officer of Florida Gas Co. He joined Transco in late 1974.*

P&GJ

First Quarter Report

Oil Glut Drags Earnings Down

by Cindy Mays, *Assistant Editor*
Energy Management Report

First quarter earnings of 72 oil companies plunged 35% from the same period in 1981, dragged down by declining prices for petroleum products resulting from the worldwide oil glut. The profit margin for the entire group fell from 5.2% to 3.7%.

Refining and marketing profits were squeezed by falling demand, sharp decline in prices, and the high cost of acquiring foreign crude in certain OPEC countries under long term purchase arrangements at official prices significantly above those of the spot market.

The major oil companies who buy their crude from high-priced Aramco were especially hard hit.

Standard Oil of California's earnings dropped 65% from the first quarter of last year. Socal said U.S. gross production of crude oil and natural gas liquids was more than offset by lower crude oil prices and higher exploration expenses.

Echoing Socal's sentiments, Mobil blamed its 49% decline on the high cost of doing business with Aramco. Texaco's quarterly earnings fell 44% from $658 million to $367 million.

"As a result of the continuing excess of oil supplies and weak petroleum demand, the downward pressure on operating margins intensified during the first quarter of 1982," said John McKinley, Texaco's chairman and CEO.

Demand for most Exxon petroleum and chemical products fell, causing a "depressing effect on selling prices which have fallen at a faster pace than crude oil supply costs." Exxon's earnings dropped 23%.

Shell Oil reported first quarter earnings of $345 million, compared to $361 million in 1981. Once again, lower prices and volumes were blamed.

On the bright side, Standard Indiana posted a 25% increase in net income due largely to the absence of losses in domestic refining, marketing and transportation operations as a result of lower crude oil costs.

Union Oil's higher margins in refining, marketing operations, and earnings from natural gas production in Thailand, resulted in a 9% gain.

Higher domestic oil production and natural gas price increases helped Atlantic Richfield's earnings rise 5%.

American Petrofina cited lower crude oil production and prices for its 21% decline.

American Quasar Petroleum's earnings jumped 149%, from $787,000 to $1.9 million. The in-

FIRST QUARTER GAS COMPANIES FINANCIAL REPORTS

	Three months ending March 31**							
	Revenues ($000)			Earnings* ($000)			Profit Margin‡	
	1982	1981	% Chg.	1982	1981	% Chg.	1982	1981
Alabama Tennessee N.G.	37,272	34,061	+ 9.4	1,671	1,638	+ 2.0	4.5	4.8
American Nat. Resources	1,063,295	889,102	+ 19.6	79,900	54,934	+ 45.5	7.5	6.2
Arkansas Louisiana Gas	398,729	339,659	+ 17.4	42,341	34,432	+ 23.0	10.6	10.1
Coastal Corp.	1,565,505	1,771,402	- 11.6	6,002	13,339	- 55.0	0.4	0.8
Columbia Gas	1,875,546	1,471,553	+ 27.5	103,963	86,369	+ 20.4	5.5	5.9
Consolidated Nat. Gas	1,200,451	1,043,042	+ 15.1	86,599	71,218	+ 21.6	7.2	6.8
ENSERCH Corp.	1,004,460	834,842	+ 20.3	57,188	55,923	+ 2.2	5.7	6.7
Houston N.G.[1]	820,113	719,477	+ 14.0	67,730	61,688	+ 9.8	8.3	8.6
InterNorth	1,452,833	1,142,615	+ 27.1	106,144	116,362	- 8.8	7.3	10.2
National Fuel Gas	398,741	336,470	+ 18.5	25,027	20,912	+ 19.7	6.3	6.2
Northwest Energy	490,963	428,700	+ 14.5	31,152	22,997	+ 35.5	6.3	5.4
ONEOK Inc.	244,022	221,117	+ 10.4	8,970	3,121	+187.4	3.7	1.4
Pacific Lighting	1,174,430	789,863	+ 48.7	28,757	39,150	- 26.5	2.4	5.0
Peoples Energy	653,533	534,057	+ 22.4	40,536	40,949	- 1.0	6.2	7.7
Pioneer Corp.	302,413	288,155	+ 4.9	29,843	29,198	+ 2.2	9.9	10.1
Sonat Inc.	815,673	678,621	+ 20.2	63,199	50,125	+ 26.1	7.7	7.4
Texas Eastern Corp.	1,424,588	1,154,547	+ 23.4	61,925	58,881	+ 5.2	4.3	5.1
Texas Gas Transmission	783,264	683,164	+ 14.7	29,791	35,641	- 16.4	3.8	5.2
Texas Oil & Gas[2]	481,713	389,659	+ 23.6	62,131	47,874	+ 29.8	12.9	12.3
Transco Companies	928,969	865,190	+ 7.4	36,062	31,386	+ 14.9	3.9	3.6
United Energy Resources	1,577,646	1,261,179	+ 25.1	64,197	55,404	+ 15.9	4.1	4.4
TOTAL	18,694,159	15,876,475	+ 17.7	1,033,128	931,541	+ 10.9	5.5	5.9

*Earnings available to common. **Excluding non-recurring items. ‡Earnings* divided by Revenues.

[1] Three months ending January 31. [2] Three months ending February 28.

FIRST QUARTER OIL COMPANIES FINANCIAL REPORTS

		Three months ending March 31**							
		Revenues ($000)			Earnings* ($000)			Profit Margin‡	
		1982	1981	% Chg.	1982	1981	% Chg.	1982	1981
1.	Alaska Interstate	95,074	91,278	+ 4.2	10,541	17,946	- 41.3	11.1	19.7
2.	Amerada Hess	2,373,216	2,969,215	- 20.1	(16,164)	174,536			5.9
3.	American Petrofina	575,214	666,474	- 13.7	15,995	20,250	- 21.0	2.8	3.0
4.	American Quasar	14,815	13,716	+ 8.0	1,959	787	+148.9	13.2	5.7
5.	Asamera	106,421	113,410	- 6.2	(1,346)	3,604			3.2
6.	Ashland Oil	2,213,151	2,366,092	- 6.5	(20,868)	715			
7.	Atlantic Richfield	6,427,156	7,132,320	- 9.9	385,409	368,324	+ 4.6	6.0	5.2
8.	Beard Oil	9,109	7,051	+ 29.2	429	1,076	- 60.1	4.7	15.3
9.	Belco Petroleum	81,630	77,737	+ 5.0	26,728	24,627	+ 8.5	32.7	31.7
10.	Callon Petroleum[1]	4,804	2,123	+126.3	680	225	+202.2	14.2	10.6
11.	Cities Service	2,277,400	2,198,900	+ 3.6	53,300	57,700	- 7.6	2.3	2.6
12.	Commonwealth Oil Ref.	164,200	304,600	- 46.1	(17,953)	(22,348)			
13.	Consolidated O&G	11,535	11,537		(2,172)	1,982			17.2
14.	Crown Central	418,266	377,368	+ 10.8	(3,046)	(10,228)			
15.	Damson Oil[2]	14,457	9,656	+ 49.7	1,303	1,069	+ 21.9	3.7	11.1
16.	Diamond Shamrock	791,135	872,650	- 9.3	29,149	51,118	- 43.0	3.7	5.9
17.	Dorchester Gas[1]	201,007	151,874	+ 32.4	3,988	6,631	- 39.9	2.0	4.4
18.	Eagle Exploration	1,578	930	+ 69.7	98	419	- 76.6	6.2	45.0
19.	Equity Oil	6,017	5,606	+ 7.3	1,238	1,151	+ 7.6	20.6	20.5
20.	Exeter Oil	1,071	1,467	- 27.0	156	445	- 65.6	14.5	31.0
21.	Exxon	27,109,000	30,323,000	- 10.6	1,240,000	1,600,000	- 22.5	4.6	5.3
22.	Freeport McMoRan	194,875	224,650	- 13.2	26,536	48,962	- 45.8	13.6	21.8
23.	Forest Oil	39,069	31,094	+ 25.6	3,425	2,282	+ 50.1	8.8	7.3
24.	Galaxy Oil	3,340	3,312	+ 0.8	(563)	17			0.5
25.	General American	85,789	85,309	+ 0.6	13,513	10,874	+ 24.3	15.8	12.7
26.	Getty Oil	3,124,577	3,294,621	- 5.2	163,646	229,930	- 28.8	5.2	7.0
27.	Gulf Oil Corp.	7,538,000	7,881,000	- 4.4	267,000	303,000	- 11.9	3.5	3.8
28.	Hadson Petroleum	10,555	2,716	+288.6	5,180	829	+524.8	49.1	30.5
29.	Hamilton Brothers Petr.	54,155	27,185	+ 99.2	5,911	5,831	+ 1.4	10.9	21.4
30.	Helmerich & Payne	94,762	75,990	+ 24.7	20,418	18,704	+ 9.2	21.5	24.6
31.	Hershey Oil	1,786	1,575	+ 13.4	225	396	- 43.2	12.6	25.1
32.	Howell Petroleum	22,814	22,179	+ 2.8	2,042	1,819	+ 12.3	8.9	8.2
33.	Inexco Oil	62,827	52,898	+ 18.8	7,607	6,345	+ 19.9	12.1	12.0
34.	MGF Oil	27,734	24,043	+ 15.4	(783)	2,055			8.5
35.	Mapco Inc.	480,836	580,021	- 17.1	16,0[illegible]3	25,435	- 37.0	3.3	4.4
36.	Marathon Oil	2,057,200	2,424,098	- 15.1	70,211	69,775	+ 0.6	3.4	2.9
37.	Maynard Oil	11,338	9,981	+ 13.6	1,015	2,316	- 56.2	9.0	23.2
38.	Mesa Petroleum	104,139	103,624	+ 0.5	29,604	29,841	- 0.8	28.4	28.8
39.	Mobil Corp.	16,400,000	17,100,000	- 4.1	326,000	640,000	- 49.1	2.0	3.7
40.	Moran Energy	29,059	24,128	+ 20.4	4,083	5,356	- 23.8	14.1	22.2
41.	Murphy Oil	744,356	666,806	+ 11.6	33,378	38,430	- 13.1	4.5	5.8
42.	Natomas	389,629	365,430	+ 6.6	49,854	58,237	- 14.4	12.8	15.9
43.	Noble Affiliates	114,688	88,719	+ 29.3	22,438	18,050	+ 24.3	19.6	20.3
44.	Occidental Petroleum	4,211,700	3,379,600	+ 24.6	39,900	248,700	- 84.0	0.9	7.4
45.	Oxoco	7,501	3,741	+100.5	1,691	474	+256.8	22.5	12.7
46.	Petroleum Development	2,228	3,281	- 32.1	(336)	355			10.8
47.	Petro-Lewis	57,664	44,617	+ 29.2	2,747	7,973	- 65.5	4.8	17.9
48.	Phillips Petroleum	3,813,000	4,229,000	- 9.8	189,000	271,000	- 30.3	5.0	6.4
49.	Prairie Producing	7,130	6,520	+ 9.4	845	1,133	- 25.4	11.9	17.4
50.	Quaker State	224,012	218,157	+ 2.7	5,824	3,636	+ 60.1	2.6	1.7
51.	Shell Oil	4,842,000	5,413,000	- 10.5	345,000	361,000	- 4.4	7.1	6.7
52.	Southland Royalty	94,838	95,680	- 0.9	8,596	9,987	- 13.9	9.1	10.4
53.	Southwestern Energy	21,011	21,008		4,314	5,518	- 21.8	20.5	26.3
54.	Standard California	9,781,000	11,601,000	- 15.7	230,000	666,000	- 65.5	2.4	5.7
55.	Standard Indiana	7,202,000	7,853,000	- 8.3	470,000	377,000	24.7	6.5	4.8
56.	Standard Ohio	3,055,600	3,194,200	- 4.3	454,700	520,400	- 12.6	14.9	16.3
57.	Statex Petroleum[3]	3,368	2,504	+ 34.5	581	589	- 1.4	17.2	23.5
58.	Sun Co.	3,900,000	4,000,000	- 2.5	124,000	120,000	+ 3.3	3.2	3.0
59.	Sundance Oil	23,364	6,250	+273.8	213	(3,888)		0.9	
60.	Tenneco	3,843,655	3,808,954	+ 1.0	113,383	178,011	- 36.3	2.9	4.7
61.	Tesoro	606,346	841,574	- 28.0	22,299	18,398	+ 21.2	3.7	2.2
62.	Texaco Inc.	13,000,000	15,500,000	- 16.0	367,000	658,000	- 44.2	2.8	4.3
63.	Texas American Energy	69,713	81,298	- 14.3	2,002	1,238	+ 61.7	2.9	1.5
64.	Tosco Corp.	823,011	762,429	+ 8.0	510	(38,688)		0.1	
65.	Transcontinental Energy	19,947	22,444	- 11.1	(1,036)	2,056			9.2
66.	Tribune Oil	569	563	+ 1.1	182	164	+ 11.0	32.0	29.1
67.	Union California	2,481,600	2,676,800	- 7.3	168,500	154,500	+ 9.1	6.8	5.8
68.	Universal Resources[3]	17,086	14,145	+ 20.8	3,008	2,808	+ 7.1	17.6	19.9
69.	Wichita Industries	2,090,855	2,757,284	+ 24.2	(377,038)	253,867			9.2
70.	Wiser Oil	14,800	16,639	- 11.1	3,642	4,737	- 23.1	20.5	28.5
71.	Woods Petroleum	20,332	16,377	+ 24.1	5,767	4,667	+ 23.6	28.4	28.5
72.	Worldwide Energy	14,145	12,630	+ 12.0	290	66	+339.4	2.1	0.5
	TOTAL	134,736,259	147,369,078	- 8.6	4,961,761	7,648,214	- 35.1	3.7	5.2

*Earnings available to common. **Excluding non-recurring items. ()Loss. ‡Earnings* divided by revenues. [1]Ends February 28. [2]Ends December 31. [3]Ends January 31.

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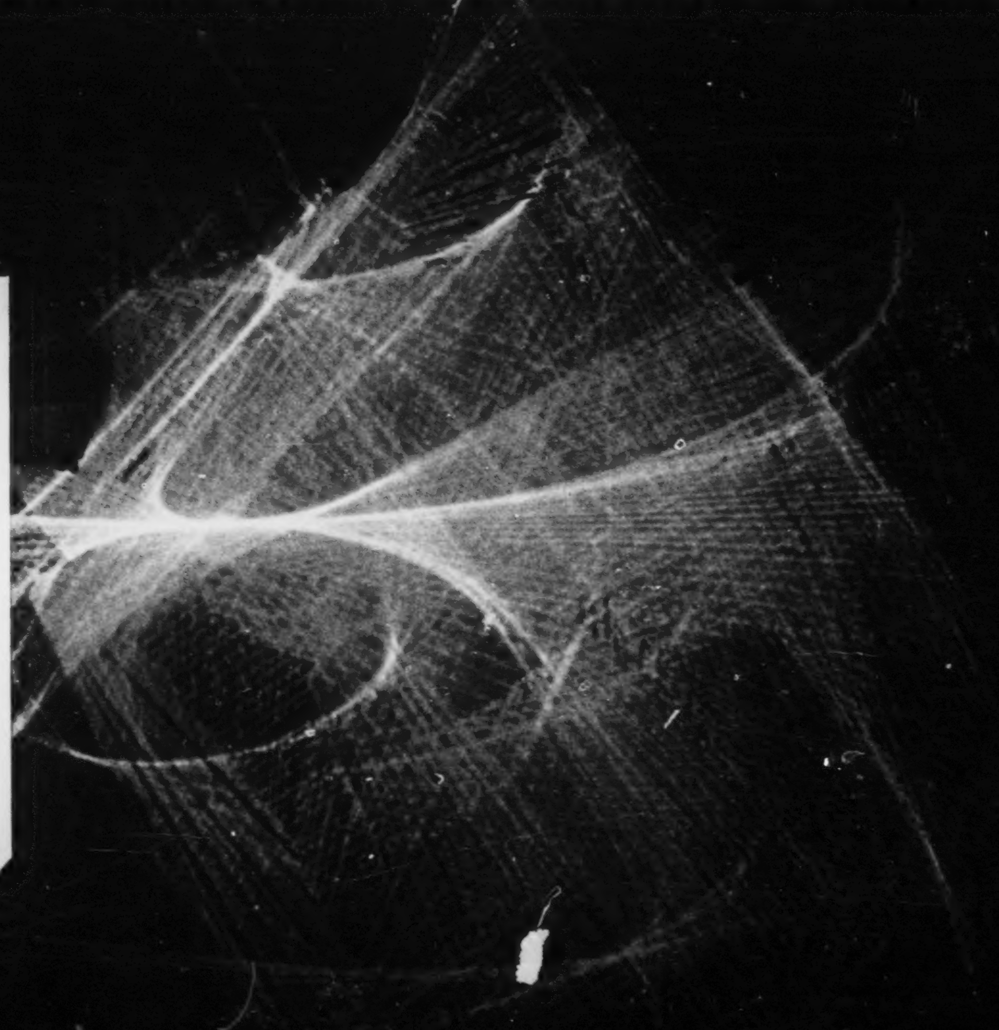

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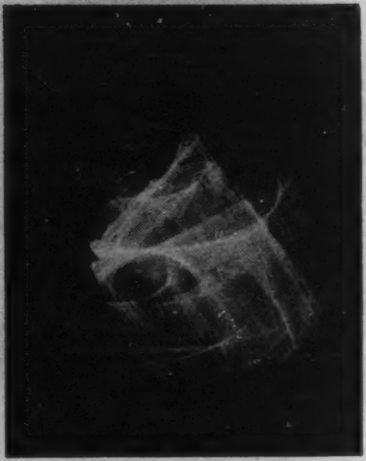

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009	032	055	078	101	124	147	170	193	216	239	262	285	308	331	354	377	400	423	446	469	492	515	538	561	584	607	630	653	676	699	722	745	768	791	814	837	860
010	033	056	079	102	125	148	171	194	217	240	263	286	309	332	355	378	401	424	447	470	493	516	539	562	585	608	631	654	677	700	723	746	769	792	815	838	861
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1982 Worldwide Pipeline Construction Will Top 21,900 Miles, $9.5 Billion

by Dean Hale, *Editor*
Pipeline & Gas Journal

Nearly 106,000 miles of crude oil, refined products, natural gas liquids, natural gas, carbon dioxide, and slurry pipelines are planned or under construction around the globe at mid-1982. That includes 73,000 miles of planned or underway lines in the free world and 33,000 miles of planned or underway lines in the Soviet Bloc countries and China,

During 1982, some 21,900 miles are projected to be completed worldwide, at a cost of $9.5 billion. In the United States, over 10,100 miles of cross-country pipelines will be installed at a cost of over $2.7 billion. In the free world outside of the U.S., another 11,800-plus miles will be completed, at a cost exceeding $6.8 billion.

Total pipeline market expenditures during 1982 – including new construction, maintenance and operations, cathodic protection, general facilities, construction and automative equipment, and all other items – will exceed $13.03 billion.

Pipeline construction activity in 1982 has slowed slightly because of lowered economic activity worldwide, and there are lessened expectations for the remainder of 1982, with an upturn forecast for 1983. Need for new pipelines to transport increasing amounts of oil and gas energy now being discovered, plus use of pipelines to transport other commodities in increasing amounts, has created a backlog of demand for facilities that must be built sometime.

1982 PIPELINE CONSTRUCTION

(Estimated miles to be completed during year)

	U.S.	International	Total
Gas			
Transmission	4022	4311	8333
Field, Gathering, Storage	2180	1740	3920
Carbon Dioxide	750	-	750
Totals	**6952**	**6051**	**13003**
Crude Oil			
Trunk Pipelines	373	1520	1893
Gathering	1496	1533	3029
Totals	**1869**	**3053**	**4922**
Refined Products			
Refined Products	488	1193	1681
LPG/Gas Liquids	330	714	1044
Totals	**818**	**1907**	**2725**
Offshore			
Oil	110	327	437
Gas	425	480	905
Totals	**535**	**807**	**1342**
GRAND TOTAL	**10174**	**11818**	**21992**
Prime Movers (est. HP Installed)			
Compressor HP	387,000	690,000	1,077,000
Pump HP	196,000	158,000	354,000
Total	**583,000**	**848,000**	**1,431,000**

Commodities suited for pipeline transportation and getting consideration include crude oil; refined products; natural gas liquids; LPG; coal slurries; carbon dioxide (used for enhanced oil recovery); chemicals such as ammonia, ethane, ethylene, and similar petrochemical feedstocks; industrial gases such as oxygen, nitrogen; and solids slurries such as ores, wood chips, and other non-soluble minerals, even items such as wood chips and wood pulp for paper-making.

Trends in the U.S. in 1982 include the building of several major carbon dioxide gas pipelines – including the 402 mile, 20 and 24-in. Sheep Mountain Line from Walsenburg, Colo. to West Texas for ARCO; the 503-mile, 30-in. Cortez Line from Cortez, Colo. to Denver City, Texas, and a 114-mile line in Oklahoma for ARCO. Several other projects are expected to be announced in late 1982 or in 1983.

The major "super projects" on the planning boards are being delayed for a variety of reasons. While over one-third of the total "Alaska Highway Gas Pipeline Project" has been completed or will be completed this year, the remaining 48-in. section in Alaska and 48 and 56-in. sections in Canada will be delayed another two years because the pipeline's backers are experiencing difficulty in financing the remainder of the $33 billion project.

Future of the 1500-mile, 40 and 42-in. Northern Tier Pipeline to carry crude oil from Washington State to Minnesota depends on success of the venture to overcome action by state officials in Washington that denied the line access to a port in the Puget Sound area.

Slurry pipeline construction is expected to get underway in early 1983 when Energy Transportation System, Inc.'s 1450-mile, 40-in. system begins installation. Curently there are 10,396 miles of coal slurry pipeline planned for the U.S. and 500 miles in Canada.

In the U.S., major projects underway in the gas transmission pipeline field include the 797-mile, 36-in. Trailblazer system in Nebraska, Wyoming, Colorado and Utah, being built for Natural Gas Pipeline Co. of America, Colorado Interstate Gas Co., and Mountain Fuel Supply Co. Red River Pipeline's 360-mile, 24-in. line is nearing completion in West Texas, and United Texas Transmission is completing a 43-mile, 30-in. line. The final 188 miles of the Northern Border Pipeline 42-in. system will be completed this year. Panhandle Eastern has 150 miles of 4 thru 12-in. underway while Valero Transmission is building 46 miles of 24 and 30-in. in South Texas. Columbia Gas has 85 miles of 20-in. in Virginia and West Virginia and another 100-plus miles planned for this year.

In the products/LPG/NGL area, MAPCO has underway 210 miles of pipeline – in the form of 105 miles of dual 4 and 6-in. line in Kansas while Ashland Oil is building 80 miles of 8-in. in Ohio.

Crude pipeline activity includes Chevron's 100 miles of 12-in. in California; Getty's 27 miles of insulated 20-in. line; ARCO's 80 miles of 4 thru 40-in. underway in Alaska on the North Slope, and Kuparuk Pipeline's 27-mile, 24-in. insulated line, also on the North Slope.

Canada expects 1982 to be a second year of high volume big-inch construction with some 785 miles of gas lines to be built plus some 1600 miles of smaller diameter lines including some 600 miles of gathering lines plus about 300 miles of gas liquids lines. Biggest projects include Foothills' 128 miles of 42-in. in southern Alberta; 128 miles of 42-in. by TransCanada PipeLines in eastern Manitoba and northwestern Ontario; a 253-mile, 42-in. "short cut" line from North Bay to Morrisburg for TCPL; and 92 miles of 24-in. for Trans Quebec & Maritimes Pipeline Inc.

Internationally, the really big projects underway or ready to begin work include the 155-mile, 20-in. NGL line in Scotland between St. Fergus and Mossmoran; 310 miles of 20 and 30-in. offshore line offshore Denmark for Danish Oil and Natural Gas, which is readying its plans for 1100 miles of mainland pipelines and 7500 miles of distribution lines.

Ireland's 160 miles of 18-in. gas line is presently underway, as are 390 miles of 42 and 48-in. for Trans-Mediterranean Pipeline in northern Italy. Norway's 530 miles of 28 and 30-in. line connecting Statfjord Field to Karsto on the mainland, then back to Ekofisk in the southern part of the North Sea.

In France, Gaz de France has nearly 200 miles of 18 to 32-in. line underway, and in West Germany, work includes 30 miles of gas lines and 83 miles of 22-in. oil line from Wilhelmshaven to Hamburg.

Construction in the Middle East includes 200 miles of gas lines in Oman, 40 miles in Qatar, and 240 miles in Saudi Arabia. North Africa construction includes a 265-mile, 48-in. gas line in Algeria, plus a 393-mile, 30-in. oil line. In Libya, work is progressing on 350 miles of 34-in. crude line.

Australian pipeline construction includes 415 miles of 14-in. gas liquids line from Moomba south to port, plus 250 miles of gathering lines in the Moomba area. Awaiting construction contract awards is the 925-mile, 20 and 26-in. Perth to Dampier gas pipeline. Work on the offshore 80-mile, 40-in. gas line in the North west Shelf area is underway.

Southeast Asia projects include 110 miles of 24-in. gas pipeline in Bangladesh and 37 miles of 20-in. gas line in Indonesia.

In Mexico, work is underway on some 277 miles of 16 to 24-in. gas transmission lines and 278 miles of 8, 10, and 12-in. products lines. In Panama, the trans-Isthmus oil line – 78 miles of 36 and 40-in. pipeline – is nearing completion, as is a 40-mile, 6-in. products line in Costa Rica.

Work in South America includes 51 miles of 12-in. gas line and 51 miles of 24-in. oil line offshore Brazil; 22 miles of gas line and 25 miles of products line in Chile; 100 miles of gas pipeline and 200 miles of crude oil pipeline in Colombia; 45 miles of oil pipeline in Peru, and 144 miles of 10 to 26-in. gas pipelines in Venezuela, plus 125 miles of 6 thru 24-in. oil pipelines.

And work on one of the most-discussed projects in the world, the Yamal pipeline that will bring gas 3300 miles from Siberia through a 56-in. line, has not yet been begun by the Soviets. Much of the material has been contracted for the line, but final arrangements await final contracts with western European nations. ■

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Details On The 500 Leading Companies Transporting Energy Through Pipelines

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International Pipeline & Gas Utility Design, Construction & Operation

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The 2nd P&GJ 500

Dimensions Of The 500 Leading Companies Transporting Energy Through Pipelines

by **Dean Hale**, *Editor*

Continuing changes in energy demand, energy prices, and energy flow patterns are reflected in the data provided by the nation's 500 leading firms that move hydrocarbon energy through pipelines.

The 1982 edition of the P&GJ 500 Report, second of its type ever done, provides a definitive reading on the dimensions of the energy pipeline network that covers all 50 states and involves nearly 2300 owner/operator entities and more than 1,460,000 miles of liquids pipelines, gas transmission pipelines, and gas mains and services.

Included in the P&GJ 500 Report are the 300 leading gas distribution utilities, the 100 leading gas transmission pipelines, and the 100 leading liquids (crude oil and products) pipelines. These firms represent the industry's leaders – they operate over 76% of the liquids pipeline mileage, 79% of the gas pipeline mileage, and serve over 97% of the nation's gas utility customers.

The P&GJ 500 Report gives details on revenues, gas sales (in MMcf per year), number of customers, net income, plant value, capital expenditures in terms of plant additions, and physical facilities in terms of miles of gas mains or miles of pipelines.

Gas Distribution Utilities. The leading 300 gas distribution utilities range in size from 3,853,931 customers to 2338 customers. The top 300 operate over 81% of the nation's gas main mileage. Again in 1981, the top two utilities were in California – Southern California Gas Co. and Pacific Gas & Electric Co. In the top 10 utilities in revenues, an increase of 22.5% ($3,860,937,000) was reported. In gas sales, the 10 leaders reported an increase of 6.3% – and additions to plant were also up 22.5%. The top 10 also reported a 6% increase in miles of mains.

Gas Transmission Pipelines. The top 10 gas transmission pipeline companies (see tables) reported an increase of 32.6% in revenues ($7.165 billion) in 1981 over 1980, a 12.8% increase in Mmcf gas sales; and an increase of 41.7% in additions to plant (up $567,276,000).

El Paso Natural Gas Co. in 1981 ranked first in revenues, first in MMcf gas sales, and seventh in plant additions; Columbia Gas Transmission ranked second in revenues, third in MMcf sales, and first in plant additions. Transco was third in revenues, seventh in MMcf sales: Tennessee Gas Pipe Line was fourth in revenues, second in MMcf sales, and third in plant additions.

Liquids Pipelines. Despite decreases in total barrels of products or crude oil handled, revenues were up for liquids pipelines in 1981. The top 10 liquids pipelines reported an increase of 3% in revenues; the top 10 products pipelines reported a decline of 4.2% in bbl of products delivered; the top 10 crude oil pipelines had a decline of 5.82% in bbl delivered.

The following summary tables provide an overview of the "top 10" companies in numerous categories; the complete tabular presentation gives a more complete dimensional measure of the P&GJ 500 companies.

The 10 Biggest Spenders – Gas Distribution Utilities (not including integrated companies)

Rank 80	Rank 81	Company Name	1981 Additions To Plant, $(000)
2	1	Southern California Gas Co.	172,898
—	2	Consolidated Gas Distribution Companies	75,802
—	3	Washington Gas Light Co.	70,925
1	4	Northern Illinois Gas Co.	69,462
6	5	Public Service Electric & Gas Co.	67,874
4	6	Consolidated Edison Co. of N.Y.	65,337
5	7	Brooklyn Union Gas Co.	53,698
7	8	Peoples Gas Light & Coke Co.	52,382
—	9	Philadelphia Gas Works	41,005
9	10	Atlanta Gas Light Co.	39,665

The 10 Biggest Spenders – Gas Transmission Pipelines (not including integrated companies)

Rank 80	Rank 81	Company Name	1981 Additions To Plant, $(000)
4	1	Columbia Gas Transmission Co.	231,278
2	2	Michigan Wisconsin Pipeline Co.	223,984
5	3	Tennessee Gas Pipe Line Co.	221,076
—	4	Northwestern Pipeline Corp.	212,634
1	5	Northern Natural Gas Co.	208,460
—	6	Texas Eastern Transmission Corp.	203,355
—	7	El Paso Natural Gas Co.	195,719
—	8	Pacific Gas Transmission Co.	173,132
9	9	Southern Natural Gas Co.	132,412
10	10	United Gas Pipe Line Co.	123,699

The 10 Biggest Spenders – Liquids Pipeline Companies

Rank 80	Rank 81	Company Name	1981 Additions To Plant $(000)
—	1	Locap, Inc.	121,061
2	2	MAPCO, Inc.	42,775
1	3	Colonial Pipeline Co.	39,245
10	4	Gulf Pipe Line Co.	31,106
—	5	Four Corners Pipe Line Co.	27,000
6	6	Exxon Pipe Line Co.	21,974
8	7	Amoco Pipeline Co.	21,761
—	8	Kaneb Pipe Line Co.	20,835
3	9	Arco Pipe Line Co.	20,378
7	10	Sohio Pipe Line Co.	19,320

The P&GJ 500 ... dimensions of the pipeline energy business

The Top 10 In Revenues – Gas Distribution Utilities

Rank			
80	81	Company Name	1981 Revenues, $(000)
2	1	Public Service Electric & Gas	3,471,652
1	2	Southern California Gas Co.	3,333,784
3	3	Columbia Gas Distribution Co.'s	2,397,640
—	4	Pacific Gas & Electric Co.	2,288,702
—	5	Lone Star Gas Co.	1,800,399
5	6	Northern Illinois Gas Co.	1,794,297
—	7	Consolidated Gas Distribution Co.'s	1,787,297
—	8	Michigan Consolidated Gas Co.	1,682,033
—	9	Consumers Power Co.	1,264,807
8	10	Peoples Gas Light & Coke Co.	1,187,650

The Top 10 Gas Distribution Utilities In Miles of Mains

Rank			
80	81	Company Name	Miles of Main
1	1	Southern California Gas Co.	38,272
2	2	Pacific Gas & Electric Co.	29,751
3	3	Columbia Gas Distribution Co.'s	27,666
4	4	Northern Illinois Gas Co.	23,636
5	5	Entex	21,542
—	6	Consolidated Gas Distribution Co.'s	20,526
—	7	Consumers Power Co.	19,404
7	8	Atlanta Gas Light Co.	16,427
8	9	Arkla, Inc.	14,914
—	10	The Gas Service Co.	12,828

The Top 10 In Revenues – Gas Transmission Pipelines

Rank			
80	81	Company Name	1981 Revenues $(000)
1	1	El Paso Natural Gas Co.	3,531,024
2	2	Columbia Gas Transmission Co.	3,429,591
4	3	Transcontinental Gas Pipeline Corp.	3,336,582
3	4	Tennessee Gas Pipeline Co.	3,276,649
5	5	United Gas Pipeline Co.	3,252,103
—	6	Pacific Gas & Electric Co.	2,954,715
—	7	Natural Gas Pipeline Co. of America	2,546,835
6	8	Texas Eastern Transmission Corp.	2,334,210
7	9	Michigan Wisconsin Pipe Line Co.	2,294,557
—	10	Valero Transmission Corp.	2,144,242

The Top 10 Gas Distribution Utilities In MMcf Gas Sales

Rank			
80	81	Company Name	Sales In MMcf
3	1	Columbia Gas Distribution Co.'s	1,204,549
1	2	Southern California Gas Co.	910,103
2	3	Pacific Gas & Electric Co.	531,293
4	4	Lone Star Gas Co. (Enserch)	527,425
5	5	Northern Illinois Gas Co.	508,033
—	6	Consolidated Gas Distribution Co.'s	499,278
6	7	Michigan Consolidated Gas Co.	423,191
8	8	Consumers Power Co.	362,858
—	9	Arkla, Inc.	330,147
10	10	Peoples Gas Light & Coke Co.	291,758

The Top 10 Gas Transmission Pipelines In MMcf Gas Sales

Rank			
80	81	Company Name	1981 Sales, MMcf
2	1	El Paso Natural Gas Co.	1,263,962
3	2	Tennessee Gas Pipeline Co.	1,138,605
4	3	Columbia Gas Transmission Co.	1,123,610
5	4	United Gas Pipe Line Co.	1,062,438
-	5	Houston Natural Gas Co.	1,025,624
-	6	Natural Gas Pipeline Co. of America	936,467
6	7	Texas Eastern Transmission Corp.	935,129
7	8	Transcontinental Gas Pipe Line Corp.	901,939
-	9	Pacific Gas & Electric Co.	812,624
8	10	Northern Natural Gas Co.	717,556

The Top 10 Gas & Electric Utilities – by Gas Customers

Rank					
80	81	Company Name	No. of Customers	1981 MMcf Sales	Miles of Mains
1	1	Pacific Gas & Electric Co.	2,897,455	531,293	29,751
2	2	Public Service Electric & Gas Co.	1,309,793	202,572	12,503
3	3	Consumers Power Co.	1,159,154	362,858	19,404
4	4	Consolidated Edison Co. of N.Y.	1,017,330	88,360	4,197
5	5	Public Service Co. of Colo.	677,663	143,658	9,504
6	6	Northern Indiana Public Service Co.	526,761	261,393	10,204
8	7	San Diego Gas & Electric Co.	513,683	89,095	5,048
7	8	Baltimore Gas & Electric Co.	512,389	105,582	4,246
9	9	Niagara Mowhawk Power Co.	424,278	109,758	5,968
10	10	Long Island Lighting Co.	395,194	48,362	5,826

The 10 Largest Integrated Gas Utilities

Rank							
80	81	Name of Company	No. of Customers	MMcf Sales	Miles of Mains	Miles of Trans. Lines	Additions To Plant $(000), 1981
1	1	Pacific Gas & Electric Co.	2,897,455	910,103	29,751	5,070	95,522
2	2	Lone Star Gas Co. (Enserch)	1,185,786	527,425	2,785	11,480	75,777
3	3	Consumers Power Co.	1,159,154	362,858	19,404	1,276	38,148
4	4	Michigan Consolidated Gas Co.	1,053,105	423,191	12,739	2,327	71,282
5	5	Arkla, Inc.	717,742	330,147	14,914	9,194	89,620
6	6	National Fuel Gas Distribution Co.	669,822	202,775	6,367	5,183	44,144
7	7	Oklahoma Natural Gas Co. (ONEOK, Inc.)	603,416	366,476	10,318	4,763	34,972
8	8	Mountain Fuel Supply Corp.	406,127	117,595	8,878	1,929	94,300
9	9	Southwest Gas Corp.	346,138	43,239	6,180	1,607	28,064
10	10	Pioneer Corp. (Energas)	280,350	124,788	3,636	12,970	45,099

The P&GJ 500 ... dimensions of the pipeline energy business

The Top 10 Liquids Pipeline Companies – In Mileage

Rank 80	Rank 81	Company Name	Total Miles Of Pipeline
1	1	Amoco Pipeline Co.	12,325
2	2	Mobil Pipeline Co.	11,820
3	3	Exxon Pipeline Co.	9,143
5	4	Arco Pipeline Co.	8,218
4	5	Williams Pipeline Co.	8,144
6	6	Shell Pipe Line Co.	7,822
7	7	MAPCO, Inc.	7,769
8	8	Continental Pipe Line Co.	7,326
9	9	Phillips Pipe Line Co.	5,697
10	10	Colonial Pipeline Co.	5,241

The Top 10 Products Pipeline Companies

Rank 80	Rank 81	Company Name	1981 Deliveries, (000) Bbl Products
1	1	Colonial Pipeline Co.	625,406
—	2	Sohio Pipe Line Co.	309,887
2	3	Buckeye Pipeline Co.	250,932
4	4	Southern Pacific Pipelines Co.	226,870
3	5	Gulf Pipe Line Co.	203,738
5	6	Marathon Pipe Line Co.	195,468
6	7	Plantation Pipe Line Co.	168,024
8	8	Williams Pipe Line Co.	165,253
—	9	Phillips Pipe Line Co.	164,690
7	10	Texas Pipe Line Co.	151,170

The Top 10 Crude Pipelines

Rank 80	Rank 81	Company Name	1981 Deliveries, (000) Bbl Crude
1	1	Arco Pipe Line Co.	505,848
2	2	Exxon Pipeline Co.	466,227
3	3	Lakehead Pipe Line Co.	406,771
4	4	Shell Pipe Line Co.	388,573
5	5	Amoco Pipeline Co.	357,578
6	6	Marathon Pipe Line Co.	298,798
7	7	Texas Pipe Line Co.	287,925
8	8	Sohio Pipe Line Co.	263,106
9	9	Gulf Pipe Line Co.	249,246
10	10	Mobil Pipe Line Co.	242,832

The Top 10 Liquids Pipelines – Revenues

Rank 80	Rank 81	Company Name	1981 Revenues $(000)
1	1	Sohio Pipe Line Co.	1,155,294
2	2	Arco Pipe Line Co.	848,121
3	3	Exxon Pipeline Co.	802,164
4	4	BP Pipelines Inc.	583,841
5	5	Colonial Pipeline Co.	394,452
7	6	Amoco Pipeline Co.	162,733
6	7	Mobil Alaska Pipeline Co.	143,086
—	8	Mobil Pipeline Co.	139,546
9	9	Williams Pipeline Co.	139,250
10	10	Shell Pipeline Co.	136,419

The 300 Leading Gas Distribution Utilities

Rank 81	Rank 82	Name of Company	Number of Customers	1981 Gas Sales, MMcf	1981 Oper Revenues $(000)	1981 Net Income $(000)	Gas plant value (000) 12-31-81	Additions to plant $(000)	Miles of Mains	Miles of Services
1	1	Southern California Gas	3,853,931	910,103	3,333,784	116,010	1,468,069	172,898	38,272	36,430
2	2	Pacific Gas & Electric Co.	2,897,455	531,293	2,288,702	133,307	1,149,109	95,522	29,751	23,616
3	3	Columbia Gas Distribution Cos.[K]	1,901,802	626,028	1,386,283	50,000[E]	675,000[E]	60,000[E]	27,666[E]	18,112[E]
—	4	Consolidated Gas Distribution Co.[L]	1,487,602	499,278	1,787,297	90,812	1,482,786	75,802	20,526	20,012
4	5	Northern Illinois Gas Co.	1,451,420	508,033	1,794,734	81,035	1,608,278	69,462	23,636	19,141
5	6	Public Service Electric & Gas Co.	1,309,793	202,572	3,471,652	264,137	1,063,006	67,874	12,503	12,392
6	7	Entex Inc.[B]	1,198,521	172,416	981,647	42,858	464,354	32,416	21,542	12,485[E]
7	8	Lone Star Gas Co.	1,185,786	527,425	1,800,399	107,472	812,072	49,054	2,785	30,964
8	9	Consumers Power Co.	1,159,154	362,858	1,264,807	85,795	1,224,158	38,148	19,404	12,075[E]
9	10	Brooklyn Union Gas Co.	1,061,922	111,947	746,944	39,223	674,206	53,698	3,729	5,215

A 1980 data
B Fiscal year ending 6-30-81
C Fiscal year ending 9-30-81
D Gas and electric combined
E Estimated
F Includes off-system sales
G Fiscal year ending 8-31-81
H Gross
I Fiscal year ending 10-31-81
J Gas and water combined
K Includes seven companies
L Includes five companies

The P&GJ 500 ... dimensions of the pipeline energy business

Rank '81	Rank '82	Name of Company	Number of Customers	1981 Gas Sales MMcf	1981 Oper Revenues $(000)	1981 Net Income $(000)	Gas plant value (000) 12-31-81	Additions to plant $(000)	Miles of Mains	Miles of Services
10	11	Michigan Consolidated Gas Co.	1,053,105	423,191	1,682,033	18,970	922,595	71,282	12,739	13,784[E]
11	12	Consolidated Edison Co. of N. Y. Inc	1,017,330	88,360	548,125	45,133	615,894	65,337	4,197	2,591
13	13	The Peoples Gas Light & Coke Co.[C]	878,109	291,758	1,187,650	42,725	931,730	52,382	4,031	5,115
14	14	The Gas Service Co.	851,297	193,138	601,771	9,708	272,026	22,917	12,828	5,554
15	15	Atlanta Gas Light Co.	819,616	226,059	829,539	14,010	535,342	39,665	16,427	14,673
16	16	Arkla, Inc.	717,792	330,147	976,069	87,560	987,446	89,620	14,914	7,477[E]
18	17	Public Service Co. of Colorado	677,663	143,658	1,219,291[D]	101,242	321,160	18,288	9,504[E]	7,058[E]
17	18	National Fuel Gas Dist. Corp.[C]	669,822	202,775	828,358	16,330	440,598	27,390	6,367[E]	6,379[E]
19	19	Oklahoma Natural Gas Co.[G]	603,416	268,177	719,558	22,168	541,249	21,792	10,318	1,264
21	20	Minnesota Gas Co.	567,464	139,969	513,385	16,447	229,221	18,993	7,963	4,934
22	21	Washington Gas Light Co.	564,042	112,876	557,977	19,244	677,387	70,925	6,726	7,965
24	22	Laclede Gas Co.	543,239	110,682	431,962	13,750	244,422	25,960	6,089	5,774
23	23	Philadelphia Gas Works[B]	534,168	84,325	437,931	8,890	516,610	41,005	2,983	3,210
25	24	Northern Indiana Public Service	526,761	261,393	844,390[D]	80,416	83,616	N/A	10,204	9,495
27	25	San Diego Gas & Electric Co.	513,683	89,095	333,104	17,758	162,406	17,797	5,048	4,094
26	26	Baltimore Gas & Electric Co.	512,389	105,582	1,421,056	149,659	351,079	18,251	4,246	4,391
28	27	Boston Gas Co.	481,049	74,197	442,418	24,331	316,141	13,148	5,666	4,202[E]
29	28	Niagara Mohawk Power Corp.	424,278	109,758	430,785	220,643	370,608	32,819	5,968	4,027
30	29	Wisconsin Gas Co.	407,969	121,376	531,769	13,961	370,966	16,553	5,900	N/A
31	30	Mountain Fuel Supply Co.	406,127	117,595	354,600	13,400	787,300	94,300	8,878	4,876
32	31	Long Island Lighting Co.	395,194	48,362	260,010	22,051	346,027	14,829	5,826	4,116[E]
33	32	Illinois Power Co.	383,474	948,097	964,292[D]	127,413	343,596	19,045	7,185	4,983
34	33	Alabama Gas Corp.[C]	352,464	82,838	311,477	4,829	113,870	8,577	6,142	7,004
35	34	Southwest Gas Corp.	346,138	114,698	432,341	9,571	310,257	28,064	3,297[E]	8,450[E]
35	35	Arizona Public Service Co.	341,184	41,284	882,154	197,434	3,688,270[D]	558,453[D]	6,180	3,904
20	36	Southern Union Gas Co.	339,700	52,566	199,837	2,087	121,766	14,196	6,222	2,563
39	37	Indiana Gas Co. Inc.	309,976	89,092	307,693	11,524	294,987	22,524	6,221	4,512
38	38	The Cincinnati Gas & Electric Co.	301,857	88,820	1,002,053	102,458	191,820	14,559	3,446	820
41	39	Philadelphia Electric Co.	293,042	72,918	356,431	23,129	371,207	40,015[D]	4,335	3,071
40	40	Peoples Natural Gas Div., NNG	292,069	152,309	476,536	6,692	138,282	7,736	9,773	3,426
42	41	Energas (Pioneer Corp.)	280,350	233,362	689,691	44,746	101,075	4,974	4,262	10,625
—	42	Gas Co. of New Mexico	278,164	71,098	304,254	2,592	140,964[H]	12,186	6,296	1,396
43	43	Northern States Power Co.	276,377	67,734	271,995	N/A	247,330	21,965	4,200	2,920
45	44	San Antonio City Public Service	265,433	25,550	105,013	48,234	146,015	8,263	3,402	2,981
44	45	Dayton Power & Light Co.	264,874	56,461	772,274	93,990	82,824	7,122	3,803	737
46	46	Equitable Gas Co.	258,441	78,148	337,665	39,803	420,995	34,978	3,342	N/A
48	47	Northwest Natural Gas Co.	252,800	74,590	358,171	16,885	283,751	28,979	7,700	4,240
47	48	Washington Natural Gas Co.[C]	249,219	59,057	313,314	10,734	293,827	23,791	5,915	5,842
49	49	Louisville Gas & Electric Co.	233,226	54,326	177,256	5,850[D]	87,544	—	926	2,221
50	50	Louisiana Gas Service Co.[C]	232,455	21,833	91,486	3,697	63,655	6,961	3,584	2,259
52	51	Memphis Gas Light & Water	230,770	64,041	202,171	-0-	155,449	7,600[E]	3,047	2,310
54	52	New Jersey Natural Gas Co.	228,118	46,912	203,255	5,510	177,385	16,827	4,317	3,772
56	53	Rochester Gas & Electric Corp.	227,953	45,828	610,102[D]	65,313	194,108	9,790	3,541	2,770
53	54	Iowa Illinois Gas & Electric Co.	223,894	61,071	227,495	47,200[D]	180,847	9,843	3,614	2,591
55	55	Bay State Gas Co.	219,802	43,068	263,877	7,278	219,099	12,544	2,324[E]	2,093[E]

The P&GJ 500 ... dimensions of the pipeline energy business

Rank '81	Rank '82	Name of Company	Number of Customers	1981 Gas Sales MMcf	1981 Oper. Revenues $(000)	1981 Net Income $(000)	Gas plant value (000) 12-31-81	Additions to plant $(000)	Miles of Mains	Miles of Services
58	56	Wisconsin Natural Gas Co.	215,523	67,811	284,943	3,858	208,894[H]	13,249	4,190	2,812
59	57	Kansas-Nebraska Nat. Gas Co. Inc	210,000	91,907	452,992	25,574	487,396	45,099	3,636	600
60	58	Citizens Gas & Coke Utility	209,115	62,532	193,197	4,226	228,249	19,081	3,247	4,145
61	59	UGI Corp.	205,437	66,066	293,080	31,965	196,415	24,256	3,243	2,020[E]
57	60	Mississippi Valley Gas Co.[F]	202,471	57,196	183,923	5,319	95,948	6,151	4,299	2,105[E]
73	61	Commonwealth Gas Co.	198,486	39,433	202,701	3,306	100,020	33,263	3,473	1,546
63	62	Piedmont Natural Gas Co.	196,472	66,324	307,308	10,038	212,410	24,646	3,351[E]	1,871[E]
62	63	Elizabethtown Gas Co.[I]	193,445	41,511	221,251	7,953	102,595	11,273	6,730	1,430
65	64	Central Illinois Light Co.[A]	183,477	48,453	140,639	29,695	183,806	17,658	3,157	2,743
72	65	Central Illinois Public Service Co.	183,397	45,275	157,953	N/A	197,350	10,375	3,180	2,777
67	66	New Orleans Public Service Inc	175,388	20,135	98,660	10,358	74,021	2,335	1,423	1,097
66	67	Peoples Gas System Inc. (Tampa)	169,261	41,541	145,387	8,443	137,793	9,313	4,152	1,884
69	68	Montana-Dakota Utilities Co.	170,234	43,785	145,784	4,916	239,500	30,262	7,232	1,599[E]
68	69	South Carolina Electric & Gas Co.	169,294	48,180	759,687[D]	82,867[D]	151,866	8,154	4,278	3,531
70	70	Northeast Utilities	152,118	29,011	207,956	N/A	N/A	N/A	2,150[E]	1,611[E]
71	71	Wisconsin Public Service Corp.	151,898	48,048	492,262	39,082	104,000	2,643	2,744	2,019
74	72	Public Service Co. of N.C. Inc.	147,534	11,647	210,576	8,996	117,554	14,374	1,959[E]	1,405[E]
75	73	Western Kentucky Gas Co.	138,678	39,114	124,132	2,091	80,828	4,837	1,835[E]	1,320[E]
76	74	Long Beach Gas Dept.	135,000[E]	27,640	126,650	14,137	22,000	—	800[E]	800[E]
—	75	Iowa Power & Light Co.	133,263	29,601	328,261	31,126	118,226	24,905	2,019	2,061
77	76	The Kansas Power & Light Co.	132,618	41,914	106,499	2,672	53,220	2,459	4,250	623
78	77	The Southern Connecticut Gas Co.	131,825	20,277	131,085	6,897	125,950[H]	9,534	1,778	2,001
79	78	Iowa Electric Light & Power Co.	131,285	35,990	345,590	24,430	61,180	3,253	2,107	1,960
80	79	New York State Electric & Gas Corp.	129,437	38,896	158,361	107,801	94,014	5,027	3,032[E]	1,233[E]
64	80	South Jersey Gas Co.	129,268	40,620	218,106	7,949	114,014	17,614	3,393	2,358
81	81	Metropolitan Util. District (Omaha)	128,871	29,353	94,644	(335)	102,437	3,923	1,702	1,938
82	82	Iowa Public Service Co.	122,328	39,195	325,793	31,412	72,343	3,872	1,860	1,669
85	83	Connecticut Natural Gas Co.	121,999	25,440	142,720	6,142	128,860	12,887	404[E]	1,161[E]
83	84	Virginia Electric & Power Co.	121,471	19,738	92,089	N/A	75,949	9,660	2,123	2,320
84	85	Providence Gas Co.	117,637	22,040	121,999	3,543	61,766	6,619	1,677	1,193
88	86	Penn Gas & Water Co.	112,464	34,531	149,966[I]	7,466	138,070	14,152	903	1,238[E]
90	87	Michigan Energy Resources Co.	104,840	34,643	138,681	3,008	110,179	7,576	2,259	2,337
91	88	Montana Power Co.	102,875	28,591	152,476	62,046[D]	180,093[H]	575	1,793	1,943
92	89	Wisconsin Power & Light	102,290	25,695	115,221	40,727[D]	93,077	7,463	2,114	775[E]
93	90	North Shore Gas Co.[C]	97,413	33,660	138,072	5,485	106,837	3,672	1,600	1,498
—	91	Midwest Natural Gas Corp.	95,403	18,042	5,819	—	—	—	118	122
94	92	City Gas Co. of Florida	94,330	10,732	45,095	2,104	41,980	3,038	1,767	984
95	93	Intermountain Gas Co.	92,703	31,747	142,331	2,246	111,347	3,647	2,998	1,757
96	94	Orange and Rockland Utilities	88,333	25,026	109,820	30,372[D]	87,605	7,950	1,439	1,169
97	95	Colonial Gas Co.	88,321	15,036	97,021	3,265	81,224	6,013	1,975	919[F]
—	96	Mobile Gas Service Co.[C]	86,832	15,511	51,427	3,109	31,264	3,690	1,221	1,578
98	97	Gulf States Utilities Co.	85,395	8,600	37,568	1,645	16,720	895	1,329	1,175
101	98	Colorado Springs Dept. Pub. Util.	84,497	16,344	64,388	(2,145)	39,356	4,330	1,261	878[E]
100	99	North Carolina Natural Gas Corp.	83,124	43,422	179,678	4,404	53,126	6,396	1,065[E]	791[E]
99	100	Cascade Natural Gas Corp.	82,596	38,499	191,226	4,168	143,400	13,437	2,808	1,382

The P&GJ 500 ... dimensions of the pipeline energy business

Rank 81	Rank 82	Name of Company	Number of Customers	1981 Gas Sales, MMcf	1981 Oper Revenues $ (000)	1981 Net Income $ (000)	Gas plant value (000) 12-31-81	Additions to plant $ (000)	Miles of Mains	Miles of Services
102	101	Washington Water Power Co.	75,408	27,820	120,999	1,167[D]	59,587	2,610	1,447	718
103	102	Delmarva Power & Light Co.	74,016	16,520	83,070	58,711[D]	66,031	2,311	95	866
104	103	Arkansas Western Gas Co.	70,381	16,400	48,600	2,300	55,281	3,500	1,409[E]	670[E]
107	104	City of Richmond, VA	69,671	14,059	59,600	2,864	33,275	20	317[E]	663[E]
—	105	Michigan Power Co.	67,865	22,059	84,717	1,620	44,270	2,876	881[E]	646[E]
109	106	Nashville Gas Co.	67,819	19,643	68,086	904	50,864	2,419	755[E]	646[E]
106	107	Madison Gas and Electric Co.	67,727	14,977	162,082[D]	12,583[D]	62,166	5,926	1,248	941
108	108	TransLouisiana Gas Co. Inc.	67,608	35,979	135,290	2,789	32,911	3,916	1,037[E]	644[E]
118	109	United Cities Gas Co.	67,269	16,173	64,599	2,047	53,503	4,646	1,764	1,142
112	110	Southeastern Michigan Gas Co.	65,901	15,050	56,253	978	75,036	9,730	1,433	986
114	111	Associated Natural Gas Co.	65,464	11,268	41,107	873	21,482	2,107	727[E]	623[E]
116	112	Greeley Gas Co.	65,364	11,372	42,445	(500)	15,419	1,699	1,454	750
111	113	Rio Grande Valley Gas Co.	65,096	6,368	31,098	1,980	30,611	2,751	517[E]	619[E]
113	114	Northwestern Public Service Co.	64,377	13,023	40,799	17,587	29,142	1,731	448[E]	613[E]
87	115	Gasco Inc.	64,300	4,890	74,600	2,600	52,100	1,400	587	531
115	116	Southern Indiana Gas & Electric Co.	62,583	19,142	57,434	20,145[D]	33,077	2,164	1,007	873
—	117	The Union Light Heat & Power Co.	60,827	13,273	137,558	1,987	51,678	3,365	720	162
120	118	City of Corpus Christi Gas Div.	57,010	5,281	21,722	N/A	N/A	N/A	447[E]	543[E]
119	119	North Central Public Service Co.	55,000[E]	26,000[E]	100,000[E]	250[E]	20,000[E]	2,000[E]	889	260
123	120	Union Gas System Inc.	53,973	13,869	35,423	274	10,992	N/A	2,810	23
124	121	Arkansas Oklahoma Gas Corp.	53,957	12,084	31,470	1,332	36,821	4,047	1,852	409
128	122	Gas Light Co. of Columbus	53,761	10,189	37,079	434	24,276	1,197	157	512
122	123	City Utilities of Springfield	53,678	10,729	34,902	1,854[D]	28,515	271	772	870
125	124	Sierra Pacific Power Co.	53,180	6,424	269,784	25,685	31,541	3,033	603[E]	430[E]
126	125	CP National Corp.	52,440	8,226	46,612	1,368	43,295	2,146	811[E]	499[E]
131	126	Missouri Utilities Co.	48,154	7,230	25,983	1,600[E]	23,035	1,600	376[E]	458[E]
134	127	Central Hudson Gas & Electric Corp.	46,285	9,480	46,489	29,679[D]	55,642	2,276	694	445
133	128	Valley Resources Inc.[C]	45,844	6,621	39,039	1,463	21,025	1,877	486	333
—	129	Northwest Natural Gas Co.[A]	45,605	7,242	33,561	UNK.	UNK.	UNK.	214	3,635
135	130	Interstate Power Co.	44,949	25,375	75,151	169	26,270	2,343	403[E]	428[E]
132	131	Energy Services of Pensacola	42,092	4,744	21,953	5,080	N/A	472	928	649
137	132	Fall River Gas Co.	40,865	6,127	38,449	N/A	N/A	N/A	439	425
139	133	Florida Public Utilities Co.	40,844	6,968	25,837	1,363	17,715	N/A	573	N/A
136	134	Missouri Public Service Co.	40,665	10,529	27,301	N/A	N/A	N/A	680	486
141	135	Iowa Southern Utilities Co.	37,968	9,026	35,180	298	14,139	774	658	558
142	136	Wisconsin Fuel & Light Co.	37,447	14,647	57,435	623	13,024	2,178	515[E]	357[E]
143	137	Wisconsin Southern Gas Co. Inc.	37,077	7,970	31,273	462	25,642	1,495	995	606
144	138	Missouri Power & Light	35,065	6,954	25,313	1,272	22,329	1,391	689	445
145	139	Terre Haute Gas Co.	32,380	16,694	43,623	N/A	N/A	N/A	465[E]	308[E]
149	140	Roanoke Gas Co.	31,485	7,689	34,114	1,329	22,397	1,033	413[E]	300[E]
148	141	Battle Creek Gas Co.	30,960	12,050	41,088	2,045	29,445	1,627	507	50
146	142	Southeast Alabama Gas District	30,815	8,478	32,300	3,725	25,513	981	944[E]	293[E]
150	143	North Penn Gas Co.[A]	30,356	UNK.	UNK.	UNK.	UNK.	UNK.	607	1,499
151	144	Haverhill Gas Co.	29,285	4,519	27,860	1,001	21,029	3,005	283[E]	279[E]
159	145	Chattanooga Gas Co.	29,195	24,016	85,411	1,732	38,198	1,579	557[E]	278[E]

The P&GJ 500 ... dimensions of the pipeline energy business

Rank		Name of Company	Number of Customers	1981 Gas Sales, MMcf	1981 Oper. Revenues $(000)	1981 Net Income $(000)	Gas plant value (000) 12-31-81	Additions to plant $(000)	Miles of Mains	Miles of Services
81	82									
171	146	Delta Natural Gas Co.	28,003	6,847	22,680	190	13,386	2,134	442[E]	267[E]
152	147	City of Salem[A]	28,000[E]	880	1,400	—	—	—	50[E]	100[E]
162	148	Berkshire Gas Co.	27,393	5,551	28,083	1,163	21,754	2,956	562	320
153	149	Penn Fuel Gas Co.	27,375	17,232	44,898	N/A	N/A	N/A	285[E]	N/A
154	150	Kokomo Gas & Fuel Co.[A]	27,231	UNK.	UNK.	UNK.	UNK.	UNK.	118	698
155	151	Portsmouth Gas Co.[A]	26,342	UNK.	UNK.	UNK.	UNK.	UNK.	513	505
157	152	Ohio Gas Co.	25,140	6,700	27,016	1,314	26,072	1,556	504	408
161	153	Ohio Valley Gas Corp.[A]	24,092	7,251	21,541	—	—	—	46	558
158	154	City of Alexandria Gas Dept.[A]	23,250	3,078	7,242	—	—	—	57	—
163	155	Cheyenne Light Fuel & Power Co.[A]	23,251	15,984	32,617	619	10,216	716	399	N/A
165	156	City of Palo Alto Utilities[B]	22,989	2,966	13,061	234	3,939	304	204	215
166	157	City of Mesa, Ariz.	22,499	2,197	9,936	720	11,282	1,012	520	277
168	158	Great Falls Gas Co.	22,324	4,486	19,407	75	9,851	501	267[E]	416[E]
167	159	City of Hamilton	22,176	4,500	16,312	96	4,671	1,353	210	N/A
169	160	Willmut Gas & Oil Co.[A]	21,259	3,756	14,561	—	—	—	475	390
170	161	City of Duluth Dept. of Water & Gas	21,215	4,880	19,108	507	21,392	3,486	204[E]	202[E]
174	162	Rocky Mountain Natural Gas Co. Inc.	20,672	3,723	19,651	134	22,824	1,934	404	379
173	163	Nebraska Natural Gas Co.[A]	20,447	6,894	16,205	—	—	—	—	—
177	164	Austell Natural Gas System	20,320	3,860	15,471	—	14,762	407	482	423
172	165	City of Albany Water, Gas & Light[A]	20,271	4,851	11,000	—	—	—	340	—
176	166	Brazos River Gas Co.[C]	19,869	2,714	10,864	(78)	4,212	171	521	37
179	167	Knoxville Utilities Board	19,304	7,133	24,670	—	—	—	643	376
183	168	Inter-City Gas Corp. Inc.[A]	19,059	15,750	56,367	—	—	—	66	513
181	169	Kansas Public Service Co.	18,075	9,654	—	—	—	—	—	253
187	170	Northern Indiana Fuel & Light Co. Inc.	18,006	5,123	18,922	881	16,099	821	468	N/A
182	171	Great River Gas Co.[A]	17,795	5,838	19,168	—	—	—	275[E]	169[E]
184	172	Union Electric Co.	17,300	2,694	11,727	531	13,694	678	95[E]	164[E]
—	173	Gulf Natural Gas Corp.	17,210	—	—	—	—	—	—	426
191	174	Pennsylvania & Southern Gas Co.[A]	17,055	5,580	20,342	—	—	—	423	221
—	175	Okaloosa County Gas District[A]	17,038	2,372	8,608	—	—	—	353	476
—	176	South Coast Gas Co.[A]	16,500[E]	1,300[E]	—	—	—	—	53	157
—	177	Jackson Utility Division[A]	15,897	5,173	11,478	—	—	—	212	151
—	178	National Oil & Gas Corp.	15,742	14,346	46,251	3,833	24,051[H]	2,940	1,024	137
190	179	Manchester Gas Co.	15,709	1,861	13,422	286	12,360	—	194	178
189	180	Citizens Utilities Co.[A]	15,430	3,186	10,877	—	—	—	447	81
192	181	Northern Gas Co.[A]	15,045	3,125	10,660	—	—	—	42	274
193	182	City of Danville Gas Department[B]	14,804	5,605	20,802	1,557	5,147	451	242	175
196	183	Fitchburg Gas & Electric Co.	14,767	2,819	48,138[D]	2,590[D]	14,229	254	145[E]	141[E]
203	184	City of Las Cruces[A]	14,657	1,554	5,827	—	—	—	302	45
193	185	City of Danville Water, Gas & Electric[A]	14,648	5,425	14,304	—	—	—	218	174
195	186	Rio Grande Natural Gas Assoc.[A]	14,500	2,500[E]	1,200[E]	—	—	—	252	138
198	187	Moran Utilities Co.[A]	14,060	1,473	10,691	—	—	—	96	287
205	188	Houma Municipal Gas System[A]	14,013	3,846	—	—	—	—	339	156
194	189	Trussville Utilities Board	13,799	1,981	10,490	1,732	16,831	115	169[E]	131[E]
—	190	Cheasapeake Utilities Corp.[A]	13,431	1,829	8,858	—	—	—	177	128

The P&GJ 500 ... dimensions of the pipeline energy business

Rank '81	Rank '82	Name of Company	Number of Customers	1981 Gas Sales, MMcf	1981 Oper Revenues $(000)	1981 Net Income $(000)	Gas plant value (000) 12-31-81	Additions to plant $(000)	Miles of Mains	Miles of Services
201	191	Great Plains Natural Gas Co.^{A}	13,107	3,712	13,721	—	—	—	65	302
—	192	Tennessee-Virginia Energy Corp.^{A}	12,905	8,494	26,838	—	—	—	443	123
—	193	Gainesville Gas Co.^{A}	12,885	293	—	—	—	—	292	277
204	194	Lancaster Municipal Gas Co.	12,664	2,103	1,138	9,137	N/A	—	161^{E}	121^{E}
210	195	Vermont Gas Systems Inc.^{A}	12,161	3,991	22,261	—	—	—	136	115
213	196	Charlottesville Gas Division	11,830	2,370	10,000	—	—	—	163	135
207	197	City of Warner Robbins Gas^{A}	11,789	5,643	6,858	—	—	—	18	190
208	198	Corning Natural Gas Corp.	11,745	12,501	40,154	402	7,453	187	317	N/A
212	199	Hobbs Gas Co.^{A}	11,087	1,503	5,819	—	—	—	25	242
211	200	Dalton Utilities^{A}	11,000	9,617	—	—	—	—	40	—
217	201	Lake Superior District Power Co.	10,628	5,541	17,512	1,776	4,536	87	229	141
215	202	Mid. Ten. Gas Utility District^{A}	10,469	2,880	10,000^{E}	—	—	—	310	576
216	203	Citizens Gas Fuel Co.	9,990	2,827	12,966	1,114	8,427	783	225	N/A
218	204	Union Gas Co.^{A}	9,751	5,260	14,261	—	—	—	232	93
225	205	Midwest Energy Inc.	9,650	1,952	5,144	(202)	3,750	206	171	N/A
—	206	Northeast Oklahoma Public Utilities^{A}	9,625	—	—	—	—	—	316	92
219	207	Hastings Utilities	9,616	242	5,508	545	—	—	140	100
230	208	Greenwood Public Works^{A}	9,581	2827	12,044	1,287	6,782	389	286	160
—	209	Marshall County Gas District^{A}	9,453	—	—	—	—	—	224	90
220	210	Southern Public Service Co.	9,416	1,467	6,090	167	3,237	266	150	100
224	211	Lynchburg Gas Co.^{A}	9,414	4,942	16,812	—	—	—	175	339
233	212	City of Rocky Mount	9,412	2,261	—	—	10,800	370	139	96
288	213	Illinois Gas Co.^{A}	9,360	1,569	—	—	—	—	248	55
222	214	Austin Utilities	9,179	2,567	8,637	478	1,666	104	55^{E}	87^{E}
223	215	City of Florence Gas Department^{A}	9,164	1,524	4,430	—	—	—	362	200
226	216	City of Pleasant Grove	9,043	872	4,799	713	500	0	179	91
228	217	Superior Water, Light & Power Co.	8,979	2,455	9,555	278	6,664	361	145	138
229	218	Cedar Falls Utilities	8,968	1,451	5,854	652	3,417	299	132	73
235	219	City of LaGrange Gas Dept.^{A}	8,570	2,000^{E}	2,500^{E}	—	—	—	140	100
231	220	Vicksburg Water and Gas^{A}	8,373	1,175	5,248	813	1,800	475	32	80
232	221	North Carolina Gas Service^{A}	8,333	1,175	5,248	813	1,800	475	32	80
248	222	Norco Gas & Fuel Co. Inc.	8,188	1,030	4,209	79	2,306	533	189	33^{E}
239	223	City of Tallahassee Muni. Gas	7,322	1,378	6,128	282	—	—	234	190
237	224	City of Norwich Public Utilities	7,203	1,030	6,702	604	~~5,446~~	~~248~~	~~106~~	
236	225	Orangeburg Dept. of Public Utilities^{A}	7,413	3,406	11,144	—	—	—	125	71
—	226	SW Texas Municipal Gas Corp.^{A}	7,358	268	—	—	—	—	163	70
239	227	Clinton-Newberry Gas Auth.^{A}	7,170	2,061	—	—	—	—	105	400
240	228	Owatonna Public Utilities	7,084	2,929	8,735	939	2,419	161	115	N/A
241	229	Graysville Municipal Gas System	7,000	578	3,163	700	2,120	0	140	30
242	230	Schagrin Gas Co.^{A}	7,000	—	—	—	—	—	—	—
244	231	City of Dyersburg Gas System^{A}	6,863	1,340	—	—	—	—	195	65
245	232	City of Del Rio Gas System^{A}	6,815	480	1,671	—	—	—	157	—
246	233	Phoenix Department of Utilities^{A}	6,651	1,393	1,086	—	—	—	77	63
—	234	Peoples Natural Gas of SC	6,295	3,530	14,811	399	4,074	840	197	190
258	235	Lake Apopka Natural Gas District	6,286	1,183	4,578	—	2,515	380	273	125

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Rank '81	Rank '82	Name of Company	Number of Customers	1981 Gas Sales, MMcf	1981 Oper Revenues $ (000)	1981 Net Income $ (000)	Gas plant value (000) 12-31-81	Additions to plant $ (000)	Miles of Mains	Miles of Services
251	236	Missouri Edison Co.	6,281	3,159	46,066[D]	2,263[D]	6,061	284	304	144
249	237	Dixie Gas Co. Inc.	6,280	545	2,358	117	1,820	20	184	30[E]
247	238	Westfield Gas & Electric Light	6,259	1,036	5,684	382	4,064	309	123	67
250	239	Liberal Gas Co.[A]	6,200	1.3	2,000	—	—	—	105	4
254	240	City of Fultondale, Gas Board[A]	6,057	577	281	—	—	—	144	60
252	241	Gibson County Utility District[A]	6,052	106	—	—	—	—	128	175
253	242	City of Wilson	6,025	873	4,262	330	2,337	296	144	57[E]
257	243	Consumers Gas Utility Co.[A]	5,954	1,019	3,490	—	—	—	266	62
—	244	City of Leesburg	5,901	716	2,843	567	1,805	N/A	121	102
256	245	Allied Gas Co.[A]	5,895	2,261	6,386	—	—	—	—	—
—	246	Gas Utilities Co.[A]	5,892	—	17,314	—	—	—	110	40
266	247	Shenandoah Gas Co.	5,806	4,181	15,675	67	10,843	1,022	224	85
262	248	City of Cartersville Gas Dept.[A]	5,720	2,250	1,856	—	—	—	89	54
259	249	Concord Natural Gas[A]	5,684	1,070	4,572	—	—	—	146	75
263	250	Bay City Gas Co.[A]	5,620	852	900	—	—	—	—	168
272	251	Watertown Gas Department	5,605	1,102	3,736	243	2,520	180	116	104
—	252	City of Vidolia[A]	5,600	191	156	—	—	—	30	53
265	253	Consumers Gas Co.[A]	5,598	1,165	3,657	—	—	—	158	102
260	254	Cullman-Jefferson Counties Gas District[A]	5,573	1,680	4,067	—	—	—	60	350
274	255	City of Sylacauga Utility Board[A]	5,531	1,390	3,581	—	—	—	472	575
261	256	The Polaris Corp.[A]	5,453	452	1,758	—	—	—	68	106
278	257	NW Alabama Gas District	5,353	5,080	18,496	2,172	15,398	1,420	403	184
270	258	The Toledo Edison Co.	5,319	1,432	4,690	244	5,254	451	106	82
264	259	Elizabethtown Natural Gas	5,298	1,347	4,386	724	1,006	—	30	130
268	260	City of Thibodaux	5,207	804	3,771	265	2,661	1,234	35[E]	50[E]
271	261	Natural Gas Distributing Co.[A]	5,197	968	2,000	—	—	—	92	16
—	262	Pike Natural Gas Co.	5,094	1,051	4,393	168	3,489	314	152	5
267	263	City of Moss Point Utilities[A]	5,090	352	479	—	—	—	95	—
281	264	Bristol-Warren Gas Co.	5,068	507	3,652	N/A	3,049	132	75	38
273	265	City of Milton Natural Gas[A]	5,000	—	1,200	—	—	—	47	43
275	266	South Penn Gas Co.[A]	4,929	2,529	6,929	—	—	—	—	—
276	267	New Ulm Public Utilities	4,915	1,741	5,713	156	1,752	39	71	N/A
279	268	City of Chanute[A]	4,822	1	—	—	—	—	38	46
277	269	Decatur Utilities	4,803	5,971	20,277	899	6,542	274	163	85
281	270	City of Fairhope Gas Dept.[A]	4,781	482	1,156	—	—	—	85	262
283	271	St. Joseph Light & Power[A]	4,695	1,224	4,543	—	—	—	52	121
286	272	City of Thomasville Water & Light[A]	4,663	859	2,561	—	—	—	97	44
284	273	Eastern Illinois Gas & Securities[A]	4,626	1,102	—	—	—	—	23	132
285	274	Oak Ridge Utility District[A]	4,594	822	1,750	—	—	—	84	44
289	275	City of Lexington, Gas Dept.	4,531	2,336	9,458	N/A	N/A	0	143	76
290	276	City of Winfield[A]	4,455	808	2,096	—	—	—	78	23
291	277	Petrolane Wyoming Gas Service[A]	4,454	925	—	—	—	—	87	—
295	278	West Tennessee Public Utility District[A]	4,415	1,829	4,896	—	—	—	314	30
292	279	Clarksville Gas Department[A]	4,379	2,826	6,755	—	—	—	164	111
293	280	Westlake Gas Department	4,376	293	1,234	193	905	42	84	45

The P&GJ 500 ... dimensions of the pipeline energy business

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297	281	Cody Gas Co.	4,269	1,847	4,912	86	4,555	372	297	N/A
—	282	Indiana Natural Gas Corp.[A]	4,240	909	2,998	175	2,250	114	145	—
—	283	City of Shelby Gas Department[A]	4,211	3,204	9,268	—	—	—	77	109
296	284	City of Dumas[A]	4,200	447	—	—	—	—	5	71
299	285	Bluefield Gas Co.[A]	4,140	1,192	4,050	—	—	—	87	20
—	286	Nebraska City Utilities[A]	4,067	912	3,057	—	—	—	—	—
298	287	Syracuse Suburban Gas Co. Inc.	4,063	4,637	17,030	151	3,864	480	80	N/A
300	288	Borough of Chambersburg Gas[A]	4,052	928	3,268	—	—	—	54	50
—	289	City of Corinth Gas & Water[A]	4,040	636	706	—	—	—	5	73
—	290	City of Deming Gas System[A]	4,011	497	—	—	—	—	38	30
—	291	Lawrenceburg Gas Co.[A]	3,841	2,977	UNK.	UNK.	UNK.	UNK.	111	14
—	292	Los Alamos County Utilities[A]	3,600	597	UNK.	UNK.	UNK.	UNK.	61	33
—	293	Las Vegas Natural Gas System[A]	3,494	1,046	UNK.	UNK.	UNK.	UNK.	101	31
—	294	Mt. Carmel Public Utility Co.[A]	3,442	576	UNK.	UNK.	UNK.	UNK.	36[E]	20[E]
	295	Laurens Commission of Public Works[A]	3,410	1,885	UNK.	UNK.	UNK.	UNK.	75	32
—	296	Central Florida Gas Corp.[A]	3,361	5,544	UNK.	UNK.	UNK.	UNK.	271	118
—	297	Fultondale Water Works and Gas Board[A]	3,328	1,355	UNK.	UNK.	UNK.	UNK.	54	31
—	298	Monarch Gas Co.	3,050	576	1,157	UNK.	UNK.	UNK.	154	20
—	299	Linton Municipal Gas[A]	2,612	597	UNK.	UNK.	UNK.	UNK.	61	33
—	300	City of Monroe	2,338	919	UNK.	UNK.	UNK.	UNK.	79	45

The 100 Leading Gas Transmission Lines

Rank '81	Rank '82	Name of Company	MILES OF PIPELINES Total	Transmission	Field Gath	Storage	1981 Gas Sales, MMcf	1981 Oper. Revenues $(000)	1981 Net	Gas Plant Value (000) 12-31-81	Additions to plant 1981 (000)
1	1	Northern Natural Gas Co.	22,488	14,675	7,675	138	717,556	2,015,712	88,279	2,007,269	208,460
2	2	El Paso Natural Gas Co.	21,251	9,331	11,920	—	1,263,962	3,531,024	160,563	2,616,586	195,719
3	3	Columbia Gas Transmission Corp.	18,126	10,046	6,858	1,222	1,123,610	3,429,591	91,051	1,769,285	231,278
4	4	Tennessee Gas Pipeline Co.	13,788	13,755	31	2	1,138,605	3,276,649	154,440	1,303,185	221,076
7	5	Kansas-Nebraska Natural Gas Co., Inc.	12,970	10,091	2,856	23	124,788	452,992	25,574	487,396	45,099
5	6	Natural Gas Pipeline Co. of America	12,338	10,465	1,777	96	936,467	2,546,835	102,377	1,911,528	80,267
6	7	Panhandle Eastern Pipe Line Co.	12,252	6,814	5,329	109	706,225	1,942,047	188,963	1,257,454	110,937
8	8	Enserch (Lone Star Gas)	11,480	8,915	2,565	—	527,425	1,800,399	107,472	1,093,358	75,777
10	9	Michigan Wisconsin Pipe Line Co.	11,165	7,700	3,285	180	644,084	2,294,557	129,390	2,220,421	223,984
9	10	Pioneer Corporation	11,128	9,880	1,248	—	290,400	1,224,645	110,204	643,935	150,544
11	11	Transcontinental Gas Pipe Line Corp.	10,820	10,576	124	120	901,939	3,336,582	93,756	2,280,527	106,359
12	12	Cities Service Gas Co.	9,711	5,835	3,696	180	365,908	954,718	46,495	553,105	35,480
13	13	Texas Eastern Transmission Corp.	9,506	9,259	48	198	935,129	2,334,210	249,669	2,076,258	203,355
14	14	United Gas Pipe Line	9,503	7,356	2,120	28	1,062,438	3,252,103	112,444	942,052	123,699
15	15	Arkla, Inc.	9,194	6,136	3,015	43	330,147	976,069	87,560	987,446	89,620
16	16	Consolidated Gas Supply Corp.	8,187	3,565	4,104	518	559,566	1,855,238	75,125	596,454	15,793
17	17	Southern Natural Gas Co.	7,497	7,319	129	48	649,086	1,981,444	99,146	1,020,074	132,412
20	18	Northwest Pipeline Corp.	6,225	3,447	2,771	7	322,166	1,352,362	73,141	789,722	212,634
18	19	Colorado Interstate Gas Co.	6,068	2,725	3,109	234	323,328	1,013,060	69,066	629,879	42,128
19	20	Texas Gas Transmission Corp.	5,891	5,613	61	217	657,181	1,687,128	139,448	766,020	23,398
59	21	Valero Transmission Co.	5,316	4,043	1,273	—	621,137	2,144,242	52,999	419,505	44,188
27	22	National Fuel Gas Supply Corp.[C]	5,183	2,697	2,018	468	209,068	614,996	14,827	217,996	17,024
23	23	Pacific Gas & Electric Co.[A]	5,070	4,123	895	52	812,624	2,248,702	133,307	1,149,109	95,522
21	24	ONEOK, Inc.[A]	4,763	4,746	—	—	366,476	970,076	41,319	541,249	13,180
24	25	Florida Gas Transmission Co.	4,283	—	—	—	189,430	559,059	32,623	173,350	36,248

A 1980 Data   B Fiscal year ending 7-31-81   C Fiscal year ending 9-30-81   D Intrastate pipeline

The P&GJ 500 ... dimensions of the pipeline energy business

Rank 81	Rank 82	Name of Company	Total	MILES OF PIPELINES Transmission	MILES OF PIPELINES Field Gath	Storage	1981 Gas Sales, MMcf	1981 Oper Revenues $(000)	1981 Net Income	Gas Plant Value (000) 12/31/81	Additions to plant 1981 (000)
—	26	Houston Natural Gas Corp.[D]	4,235	1,200	3,000	35	1,025,624	2,095,809	214,746	72,022	35,779
25	27	Columbia Gulf Transmission Co.	4,096	2,543	1,553	—	673,804	169,164	40,043	969,249	51,657
29	28	Montana-Dakota Utilities Co.	4,037	3,114	923	—	43,786	145,784	4,916	239,500	30,262
26	29	Transwestern Pipeline Co.	4,012	—	—	—	314,184	918,877	46,236	528,757	62,371
—	30	Public Service Co. of N.C., Inc.	3,971	—	—	—	44,368	210,577	8,997	117,554	14,374
22	31	Trunkline Gas Co.	3,915	—	—	—	524,400	1,545,104	57,971	899,062	70,253
32	32	Mitchell Energy & Development Corp.	2,900	—	—	—	114,574	1,064,844	115,217	130,476	39,757
28	33	The Montana Power Co.	2,784	1,804	926	54	40,919	362,486	62,046	262,803	31,763
—	34	North Carolina Natural Gas Corp.	2,695	839	1,856	—	43,422	179,678	4,404	79,970	6,396
30	35	Peoples Natural Gas	2,329	1,051	1,240	38	N/A	N/A	N/A	N/A	N/A
31	36	Michigan Consolidated Gas Co.	2,327	2,185	35	107	420,877	1,704,841	18,970	1,247,784	63,071
33	37	Mississippi River Trans. Corp.	2,209	1,969	167	73	189,333	606,986	37,226	309,397	40,405
34	38	Equitable Gas Company	2,096	476	1,492	128	91,060	337,656	39,804	420,995	34,789
35	39	Kentucky West Virginia Gas Co.	2,044	27	2,016	—	27,390	53,420	24,469	142,244	4,400
36	40	Western Slope Gas Company	2,030	1,563	447	20	48,719	158,579	906	90,898	9,732
—	41	Western Gas Pipeline Co.	1,989	1,174	801	14	99,081	244,444	1,227	114,929	13,251
37	42	Transok Pipe Line Co.	1,938	781	1,157	—	217,000	152,995	5,219	62,682	3,096
39	43	Mountain Fuel Supply Co.	1,929	1,303	616	9	115,038	354,640	18,771	550,427	59,757
38	44	Louisiana Intrastate Gas Corp.	1,874	1,874	—	—	203,617	844,854	59,168	243,624	21,267
40	45	Southwest Gas Corp.	1,607	1,607	—	—	114,968	432,391	9,571	310,257	28,064
41	46	National Fuel Gas Dist.	1,515	1,176	339	—	201,145	848,988	15,937	441,529	39,008
42	47	Central Illinois Public Service Co.	1,386	1,359	14	13	101,714	529,391	61,849	120,608	5,310
43	48	Consumers Power Co.[A]	1,276	1,114	22	140	340,762	986,350	65,427	1,195,295	61,429
44	49	Great Lakes Gas Transmission Co.	1,274	1,274	—	—	71,732	522,434	21,358	465,649	40,910
45	50	Carnegie Natural Gas Co.	1,170	256	914	—	24,880	73,134	4,554	65,294	4,760
48	51	Carolina Pipeline Co.[A]	1,017	1,017	—	—	34,452	105,448	6,555	44,841	1,090
47	52	East Tennessee Natural Gas Co.	1,012	1,012	—	—	81,825	243,988	7,185	59,654	2,132
58	53	Arkansas Oklahoma Gas Corp.	983	571	409	3	12,084	31,470	1,332	36,821	4,047
51	54	Arkansas Western Gas Co.	942	688	250	4	47,281	48,640	2,293	57,560	4,982
50	55	Midwestern Gas Transmission Co.	915	903	10	2	291,501	1,035,756	8,312	142,789	1,658
52	56	Algonquin Gas Transmission Co.	909	909	—	—	155,350	564,194	13,893	178,529	3,908
49	57	North Penn Gas Co.	891	587	291	13	21,940	74,839	1,079	33,345	1,692
53	58	Mid Louisiana Gas Co.	799	398	401	—	33,001	108,811	8,703	62,187	6,583
56	59	Pacific Gas Transmission Co.	799	799	—	—	258,458	1,317,827	31,180	366,037	173,132
54	60	South Georgia Natural Gas Co.	767	767	—	—	32,878	120,287	12,011	18,900	643
55	61	Michigan Gas Storage Co.	716	568	—	148	98,467	246,911	2,282	52,092	688
57	62	Associated Natural Gas Co.	602	602	—	—	11,268	41,107	873	35,887	2,227
59	63	Valero Interstate Trans. Co.	564	320	244	—	19,903	41,342	339	23,124	3,246
—	64	Channel Industries Gas Co.	551	551	—	—	129,586	436,953	4,590	41,800	7,020
60	65	Inland Gas Co., Inc.	531	94	437	—	10,596	30,150	2,698	22,311	1,494
—	66	Commonwealth Gas Pipeline Corp.	529	529	—	—	68,139	229,848	3,576	40,384	785
63	67	Tejas Gas Corp.	519	519	—	—	58,140	101,418	8,141	37,000	13,500
61	68	Northern Utilities, Inc.	502	456	46	—	10,854	41,765	955	24,237	1,777
62	69	Ohio Valley Gas Corp.[A]	482	152	330	—	6,458	19,006	506	11,748	925
64	70	Sea Robin Pipeline Co.	430	430	—	—	257,887	503,941	7,701	237,657	11,411

The P&GJ 500 ... dimensions of the pipeline energy business

Rank 81	Rank 82	Name of Company	MILES OF PIPELINES Total	Transmission	Field. Gath	Storage	1981 Gas Sales, MMcf	1981 Oper Revenues $(000)	1981 Net Income	Gas Plant Value (000) 12-31-81	Additions to plant 1981 (000)
65	71	Washington Gas Light Co.	371	371	—	—	107,444	530,829	19,247	616,380	61,164
—	72	Mountain Fuel Resources	365	123	212	30	4,684	18,499	3,241	52,942	5,196
—	73	Pacific Interstate Trans. Co.	351	351	—	—	9,146	78,741	4,186	56,557	56,553
67	74	Stingray Pipeline Co.	325	325	—	—	N/A	46,774	9,747	234,776	1,170
68	75	Alabama-Tennessee Natural Gas Co.	315	314	1	—	35,469	116,805	5,786	17,689	645
69	76	Louisville Gas & Electric Co.^{A}	306	178	—	128	58,307	443,893	42,173	132,989	4,973
70	77	Northern Gas Company	303	230	61	12	7,404	28,172	(873)	9,864	1,360
72	78	Western Gas Interstate Co.	295	243	52	—	5,035	13,749	58	7,045	2,858
71	79	Ringwood Gathering Co.	294	26	268	—	12,123	22,108	251	10,366	1,308
—	80	Esperanza Transmission Co.	275	275	—	—	20,181	76,232	3,911	8,870	6,740
75	81	Eastern Shore Natural Gas Co.	247	247	—	—	8,528	38,326	2,298	7,336	255
74	82	South Jersey Gas Co.^{A}	241	239	2	—	41,988	177,605	9,644	138,047	14,768
73	83	Delta Natural Gas Co., Inc.	241	174	67	—	6,317	24,723	270	15,732	4,415
77	84	Valley Gas Transmission Inc.	239	—	239	—	5,888	16,038	174	4,711	840
76	85	St. Lawrence Gas^A	234	234	—	—	6,342	31,393	228	10,993	366
78	86	Alaska Pipeline Co.	225	218	7	—	31,706	N/A	N/A	N/A	N/A
79	87	High Island Offshore System	203	203	—	—	N/A	88,557	9,111	342,728	3,442
80	88	Consolidated Systems LNG Co.	200	200	—	—	N/A	25,137	228	269,002	379
81	89	Standard Pacific Gas Line Inc.	190	185	5	—	N/A	1,086	(332)	(11,912)	N/A
82	90	McCullouch Interstate Gas Corp.	187	187	—	—	4,194	10,650	298	9,418	119
83	91	Peoples Natural Gas Co. of S.C.^{A}	183	183	—	—	N/A	9,980	321	5,210	681
84	92	Sabine Pipe Line Co.	174	174	—	—	N/A	1,622	221	19,115	N/A
85	93	Chandeleur Pipe Line Co.	161	161		—	N/A	1,129	(336)	15,984	N/A
86	94	San Diego Gas & Electric^A	138	129	—	9	88,483	299,036	16,563	154,297	18,930
87	95	West Texas Gathering Co.	127	59	68	—	31,198	33,299	63	4,316	22
88	96	Gas Transport, Inc.	109	41	68	—	3,799	12,733	1,334	3,659	36
—	97	Tenngasco Gas Gathering Co.^{D}	104	104	—	—	26,685	80,475	2,179	11,972	169
89	98	Columbia LNG Co.	88	88	—	—	N/A	20,863	(657)	202,558	273
91	99	Lone Star Gathering Co.	85	78	7	—	N/A	382	66	2,406	44
—	100	Louisiana-Nevada Transit Co.	—	—	—	—	—	—	—	—	—

The 100 Leading Liquid Pipelines

Rank 80	Rank 81	Name of Company	Bbl delivered out of system in 1981: Crude oil	Products	Total	1981 Financial (000): Oper Rev	Net Income	Property Value (000) 12-31-81	Changes in Prop. Val. $(000)	Miles of Lines Owned Operated: Gath Lines	Crude Trunk	Products Trunk	Total
1	1	ARCO Pipe Line Co.	505,848	147,577	653,425	848,121	242,814	2,397,830	20,378	1,807	2,673	3,738	8,218
2	2	Colonial Pipeline Co.	—	625,406	625,406	394,452	79,693	1,300,303	39,245	—	—	5,241	5,241
4	3	Shell Pipe Line Corp.	388,573	139,738	528,311	136,419	27,352	418,887	17,356	2,195	5,235	392	7,822
3	4	Exxon Pipeline Co.	466,227	53,830	520,057	802,164	287,975	2,189,881	21,974	1,928	4,858	2,357	9,143
6	5	Marathon Pipe Line Co.	298,798	195,468	494,267	91,140	39,799	328,285	18,219	1,057	1,542	1,379	3,978
5	6	Amoco Pipeline Co.	357,578	121,678	479,256	162,733	51,962	484,766	21,761	2,327	7,871	2,127	12,325
7	7	Gulf Pipeline Co.	249,246	203,738	452,984	77,592	18,483	268,699	31,106	1,981	1,160	2,039	4,180
8	8	Texas Pipe Line Co.	287,925	151,170	439,095	91,130	28,569	255,168	12,328	1,244	2,492	539	4,275
9	9	Lakehead Pipe Line Co.	406,771	—	406,771	133,283	30,577	440,280	(1,485)	—	2,601	—	2,601
10	10	Mobil Pipe Line Co.	242,832	90,524	333,357	139,546	51,257	278,749	4,915	4,379	5,145	2,296	11,820

E. Under construction in 1981 and test and check out, common carrier operations began Jan. 1, 1982

F. Owns share of Alyeska (TAPS) system

G. Does not include ownership interest in lines operated by other carriers

The P&GJ 500 ... dimensions of the pipeline energy business

Rank '80	Rank '81	Name of Company	Bbl delivered out of system in 1981: Crude oil	Products	Total	1981 Financial (000): Oper Rev	Net Income	Property Value (000) 12-31-81	Changes in Prop. Val., $(000)	Miles of Lines Owned/Operated: Gath. Lines	Crude Trunk	Products Trunk	Total
11	11	Sohio Pipe Line Co.	263,106	46,780	309,887	1,155,294	312,593	3,276,082	19,320	1,072	802	130	2,004
12	12	Buckeye Pipeline Co.	10,621	250,933	261,554	97,161	31,372	339,680	19,082	—	131	3,421	3,552
13	13	Phillips Pipe Line Co.	87,253	164,690	251,943	104,499	17,028	322,820	2,584	1,099	1,956	2,642	5,697
14	14	Southern Pacific Pipe Lines, Inc.	—	226,870	226,870	63,750	21,876	142,897	3,561	—	—	2,511	2,511
15	15	Sun Pipe Line Co.	106,319	86,467	192,787	56,099	30,805	125,491	(8,856)	3,135	—	—	3,135
19	16	Chevron Pipe Line Co.	155,770	35,065	190,836	49,213	9,239	179,612	18,452	214	1,437	1,490	3,141
16	17	Continental Pipe Line Co.	136,897	45,950	182,847	54,216	21,448	154,618	10,261	4,041	1,480	1,805	7,326
21	18	Cities Service Pipe Line Co.	175,765	5,767	181,533	22,017	2,996	60,997	3,744	626	876	110	1,612
18	19	Williams Pipe Line Co.	8,436	165,253	173,689	139,250	29,286	437,403	(10,383)	—	82	8,062	8,144
17	20	Plantation Pipe Line Co.	—	168,024	168,024	80,732	13,373	283,948	1,392	—	—	3,154	3,154
20	21	Texas-New Mexico Pipe Line Co.	157,207	—	157,207	31,151	7,140	86,592	468	1,894	2,219	—	4,113
23	22	Mapco, Inc.	—	138,539	138,539	87,476	31,924	404,014	42,775	—	—	7,769	7,769
25	23	Texas Eastern Products P/L Co.	195	128,068	128,264	92,342	N/A	393,016	8,320	—	—	3,385	3,385
27	24	West Texas Gulf Pipe Line Co.	118,343	—	118,343	19,942	4,628	44,821	235	—	581	—	581
29	25	Four Corners Pipe Line Co.	87,218	15,753	102,971	37,732	9,863	121,390	27,000	295	1,115	24	1,434
34	26	Pure Transportation Co.	74,200	18,917	93,117	23,861	8,019	67,973	162	833	704	12	1,549
24	27	Chicap Pipe Line Co.	91,839	—	91,839	12,322	2,814	38,520	201	—	235	—	235
26	28	Ashland Pipe Line Co.	91,825	—	91,825	36,782	11,467	91,873	1,732	453	859	—	1,312
31	29	BP Pipelines, Inc.	91,451	—	91,451	583,841	251,659	1,588,839	7,220	—	818	—	818
33	30	Explorer Pipeline Co.	—	90,725	90,725	42,206	3,656	249,480	928	—	—	1,397	1,397
32	31	Wolverine Pipe Line Co.	—	81,423	81,423	21,392	4,422	70,825	392	—	—	620	620
35	32	Olympic Pipeline Co.	—	72,308	72,308	19,368	5,359	56,498	167	—	—	391	391
37	33	Lake Charles Pipe Line Co.	—	71,773	71,773	2,779	(35)	10,329	538	—	—	13	13
30	34	Texaco-Cities Service P/L Co.	66,420	2,778	69,208	8,955	2,334	64,356	13,109	—	581	106	687
41	35	Portland Pipe Line Corp.	64,513	—	64,513	17,670	3,546	53,076	324	—	513	—	513
38	36	Owensboro-Ashland Co.	60,004	—	60,004	9,627	1,377	43,511	670	—	295	—	295
44	37	Seaway Pipeline, Inc.	59,161	—	59,161	17,487	(15,092)	209,007	97	—	515	—	515
36	38	Southcap Pipe Line Co.	57,913	—	57,913	15,899	2,739	53,345	275	—	—	—	—
28	39	Texoma Pipe Line Co.	57,066	—	57,066	23,418	101	140,145	4,392	—	504	—	504
39	40	Badger Pipe Line Co.	—	55,030	55,030	9,973	1,746	24,003	1,010	—	—	328	328
42	41	West Shore Pipe Line Co.	—	54,295	54,295	12,437	2,849	32,509	294	—	—	323	323
47	42	Platte Pipe Line Co.	49,811	—	49,811	21,357	5,606	70,255	416	—	1,280	—	1,280
66	43	Total Pipeline Corp.	34,724	12,444	47,168	7,924	1,256	22,976	791	231	436	64	731
48	44	Santa Fe Pipeline Co.	—	44,983	44,983	32,024	4,491	47,811	321	—	—	899	899
40	45	Amdel Pipeline Inc.	33,309	9,915	43,224	5,305	652	25,545	6,228	10	529	28	567
53	46	Minnesota Pipe Line Co.	42,638	—	42,638	11,200	2,346	28,586	—	—	365	—	365
55	47	Dixie Pipeline Co.	—	37,176	37,176	42,661	11,301	71,803	1,462	—	—	1,305	1,305
51	48	Kaneb Pipe Line Co.	—	37,176	37,176	19,864	4,988	65,486	20,835	—	—	1,458	1,458
45	49	Osage Pipe Line Co.	35,871	—	35,871	5,363	972	19,593	—	—	136	—	136
56	50	Hydrocarbon Transportation Inc.	—	35,690	35,690	34,486	6,863	127,442	2,780	—	—	1,514	1,514
50	51	Shamrock Pipeline Corp.	23,780	11,646	35,426	14,865	4,702	18,736	1,877	628	316	544	1,488
52	52	Dome Pipeline Corp.	—	35,347	35,347	6,804	8,193	21,913	163	1	8	129	138
43	53	Hess Pipeline Co.	34,111	—	34,111	8,464	1,457	50,117	14,508	—	356	—	356
57	54	Collins Pipeline Co.	—	33,793	33,793	3,548	882	14,311	14,727	—	—	124	124
49	55	Oiltanking of Texas P/L Co.	33,089	—	33,089	2,633	(155)	11,260	2,875	—	19	—	19

The P&GJ 500 ... dimensions of the pipeline energy business

Rank 80	Rank 81	Name of Company	Bbl delivered out of system in 1981: Crude oil	Products	Total	1981 Financial (000): Oper Rev.	Net Income	Property Value (000) 12-31-81	Changes in Prop. Val., $(000)	Miles of Lines Owned Operated: Gath. Lines	Crude Trunk	Products Trunk	Total
46	56	Tecumseh Pipe Line Co.	32,680	—	32,680	2,150	521	15,247	86	—	206	—	206
58	57	Butte Pipe Line Co.	32,436	—	32,436	9,166	2,156	17,614	123	—	373	—	373
63	58	Wesco Pipe Line Co.	31,580	—	31,580	13,996	4,483	61,125	27,492	207	585	—	792
54	59	Laurel Pipe Line Co.	—	30,674	30,674	12,347	2,612	56,666	550	—	—	453	453
22	60	Mid-Valley Pipe Line Co.	30,212	—	30,212	46,642	8,873	113,847	717	—	1,099	—	1,099
59	61	Belle Fourche Pipe Line Co.	27,813	—	27,813	13,337	3,227	44,979	1,221	941	729	—	1,670
61	62	Jayhawk Pipeline Corp.	27,283	—	27,283	5,044	278	20,176	269	230	513	—	743
65	63	Cochin Pipeline System	—	26,753	26,753	62,278	34,230	240,987	—	—	—	1,200	1,200
60	64	Cook Inlet Pipe Line Co.	24,756	—	24,756	14,092	2,101	42,309	2	—	55	—	55
—	65	LOOP, Inc.[E]	24,607[F]	—	24,607[F]	—	—	711,219	—	—	48	—	48
67	66	CRA, Inc.	24,001	—	24,001	3,086	624	10,346	(72)	652	242	6	900
64	67	Mobil Alaska Pipeline Co.	22,594	—	22,594	143,086	59,154	392,444	1,678	—	818[F]	—	—
70	68	Calnev Pipe Line Co.	—	22,262	22,262	10,063	5,894	29,341	3,759	—	—	566	566
62	69	Getty Pipeline, Inc.	11,099	10,460	21,559	1,560	3,352	10,033	660	—	29	341	370
72	70	Kenai Pipe Line Co.	20,101	—	20,101	6,133	1,579	12,271	(826)	—	23	—	23
73	71	Chase Transportation Co.	—	20,050	20,050	10,311	8,767	38,530	6,517	—	—	697	697
—	72	Locap, Inc.	19,553	—	19,553	148	10,625	121,061	121,061	—	58	—	58
71	73	Yellowstone Pipe Line Co.	—	18,835	18,835	8,505	1,653	27,891	64	—	—	751	751
69	74	Ohio River Pipe Line Co.	—	18,821	18,821	3,183	716	9,087	3,821	—	—	364	364
75	75	Diamond Shamrock Corp.	—	17,687	17,687	10,259	2,410	32,117	5,130	—	—	622	622
76	76	Portal Pipe Line Co.	16,900	—	16,900	13,300	6,200	33,000	6,000	—	81	—	81
79	77	Kaw Pipe Line Co.	16,346	—	16,346	4,610	905	11,842	(97)	1,401	—	—	1,401
68	78	American Petrofina Pipeline Co.	15,218	866	16,084	4,548	(2,035)	11,308	442	161	538	46	745
74	79	Wyco Pipe Line Co.	—	15,816	15,816	8,445	2,119	23,761	564	—	—	677	677
80	80	Gulf Central Pipeline Co.	—	14,694	14,694	23,265	6,839	120,976	289	—	—	1,945	1,945
78	81	Acorn Pipe Line Co.	14,412	—	14,412	3,680	—	3,336	(6)	—[G]	—	—	—
77	82	Paloma Pipe Line Company	19,945	-0-	13,945	4,304	1,842	5,776	—	—[G]	—	—	—
84	83	Okie Pipe Line Co.	7,224	6,151	13,375	8,160	2,922	14,067	—	500	—	384	884
81	84	Kiantone Pipeline Corp.	12,364	—	12,364	2,383	311	13,050	559	—	78	—	78
82	85	Western Oil Transportation Co., Inc.	11,183	—	11,183	3,102	24,352	14,690	—	UNK.	UNK.	UNK.	UNK.
87	86	Pioneer Pipe Line Co.	—	11,074	11,074	3,852	1,083	11,819	74	—	—	303	303
85	87	Allegheny Pipeline Co.	—	10,778	10,778	6,567	4,187	26,414	1,883	—	—	602	602
86	88	Jet Lines, Inc.	—	9,686	9,686	3,974	947	12,101	645	—	—	111	111
89	89	Interstate Energy Co.	—	9,866	9,866	10,627	—	55,143	305	—	—	94	94
92	90	Trans-Oil Pipeline Co.	—	9,752	9,752	2,520	2,067	13,835	0.8	—	—	133	133
94	91	Amerada Hess Pipeline Corp.	8,293	—	8,293	53,453	18,787	47,211	659	—	(818)[F]	—	—
93	92	Trans Mountain Oil pipe Line Corp.	7,743	—	7,743	324	(1,770)	6,743	—	—	—	—	—
90	93	Union Alaska Pipeline Co.	7,490	—	7,490	45,626	17,885	124,369	—	—	(818)[F]	—	—
91	94	Phillips Alaska Pipeline Corp.	7,471	—	7,471	46,487	21,405	124,648	781	—	(818)[F]	—	—
—	95	Black Lake Pipe Line Co.	6,733	—	6,733	2,480	778	10,043	55	—	255	—	255
98	96	POGO Offshore Pipeline Co.	6,595	—	6,595	3,001	1,264	8,780	833	—	(112)[G]	—	—
97	97	Mobil Eugene Island Pipeline Co.	6,557	—	6,557	3,518	1,019	13,479	365	—	(181)[G]	—	—
99	98	Cheyenne Pipeline Co.	144	5,715	5,859	1,826	741	5,951	32	5	34	220	259
—	99	Ohio Gathering Corp.	5,395	—	5,395	8,818	507	7,246	991	754	—	—	754
95	100	Crown-Rancho Pipe Line Corp.	5,074	—	5,074	1,176	519	2,186	(4)	7	—	—	7

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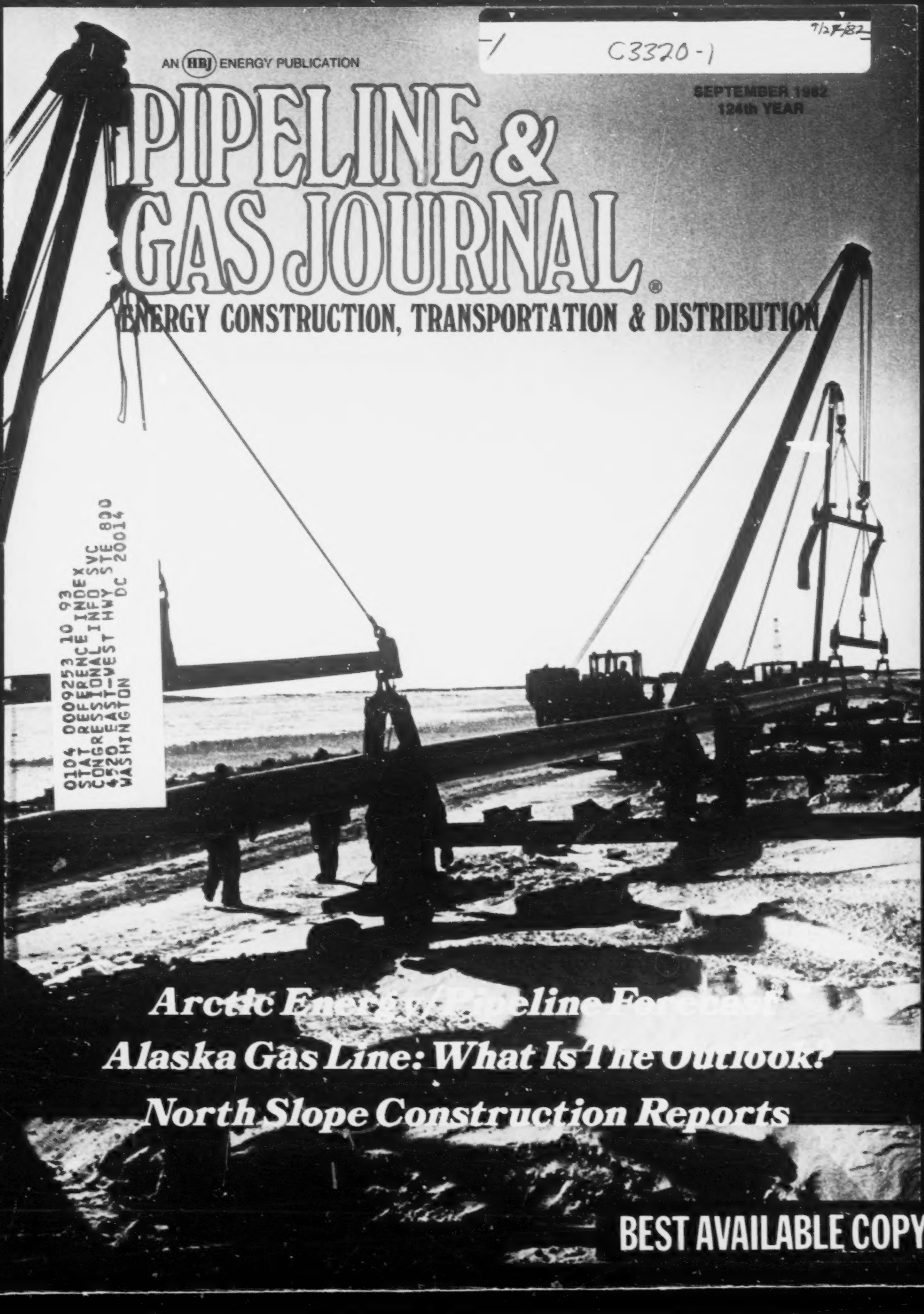

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Arctic Energy/Pipeline Forecast

Alaska Gas Line: What Is The Outlook?

North Slope Construction Reports

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COVER
Warmly-clad workmen brave the Arctic cold on the North Slope of Alaska as they install an insulated 16-in. oil pipeline from the Kuparuk Field, third largest in terms of reserves in North America, to a tie-in with the trans-Alaska oil pipeline at Prudhoe Bay.

–Photo photo courtesy Morrison-Knudsen Construction Co.

North Slope Pipeline Work Strong 17
Even though the gas pipeline has been delayed, it hasn't bothered pipeline construction activity on the North Slope where a $10.5-billion production maintenance program means 225 plus miles of pipelines needed in 1982-1983.

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New Fairbanks Facility Produces High Volume of Insulated Pipe 28
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Multitude of testing and development programs by Foothills Pipe Lines has produced new and novel ideas in equipment for Arctic construction and new techniques for pipeline design in the colder climates.

Canadian Eastern Leg Complete 65
The final 128.6 miles of 42-in. gas line built by Marine Pipeline Construction for Foothills Pipe Lines in Alberta filled the last gap in the southern Canadian portion of the Alaska gas pipeline.

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New Concept Improves Ultrasonic Inspection Of ERW Pipe 76
Imperfections in longitudinal welds on heavy wall electric resistance welded pipe can be found more precisely at mill speeds with a new inspection system.

Over 100 miles of insulated pipelines will be installed on the North Slope of Alaska during 1982 – and another 120 miles in 1983 – as part of a $10.5 billion project to maintain production capacity. New lines are for waterflood supply systems, low pressure production systems, produced water handling, and gas handling.

North Slope Pipeline Work Strong; Gas Pipeline Project Deferred

by Dean Hale, Editor

Even with an additional two-year delay foreseen for the Alaska Highway Gas Pipeline Project, pipeline construction and planning continues at an energetic level in the colder climes of North America.

Pipeline construction on the North Slope is quite active at both Prudhoe Bay, where Arco and Sohio respectively are installing facilities for a planned waterflood system as well as additional flowlines and other pipelines, and at Kuparuk Field, west of Prudhoe Bay, where development by Arco continues.

The delay of two years in implementing the construction plan for the Alaska Highway Gas Pipeline Project is only a temporary setback, sponsors say, and the project assuredly will be built in the mid-1980s – and possibly sooner if a demand develops for the Alaskan natural gas and there is an economic upturn coupled with a better money market.

Inability to produce a complete financing program by July – to meet an FERC deadline – moved the project sponsors in early May to announce the delay. Informed sources tell P&GJ that two-thirds of the pipeline financing could be arranged – one-third by the pipeline sponsors, one-third by the North Slope producers – and that the producers were not willing to assume part of the remaining one-third. Financing of that elusive "other one-third" may be offered to the state of Alaska and outside (of the gas industry) institutions.

Meanwhile, some 26 Tcf of natural gas remains "frozen" in place on the North Slope and unavailable to the lower 48 states, a market that is also soft with an increasing supply available but unused.

Of the 1972 miles completed of the total 4784 Alaska Highway Gas Pipeline Project, including both western and eastern legs in the U.S., 1335 miles are below the U.S.-Canadian border (Northern Border Pipeline – 823 miles; Pacific Gas Transmission – 161 miles; Northwest Pipeline – 351 miles) and 637 miles in Canada installed by Foothills Pipe Lines. Another 2812 miles remain – 745 in Alaska, 1346 in Canada between the Alaska-Yukon border and James River Junction, and 721 miles of additional line by Pacific Gas Transmission and PG&E. To be built at a later date is the 740-mile, 34-in. Dempster lateral from Whitehorse to the Mackenzie River Delta.

There are alternatives to building the gas pipeline as originally planned, but they have not received serious consideration.

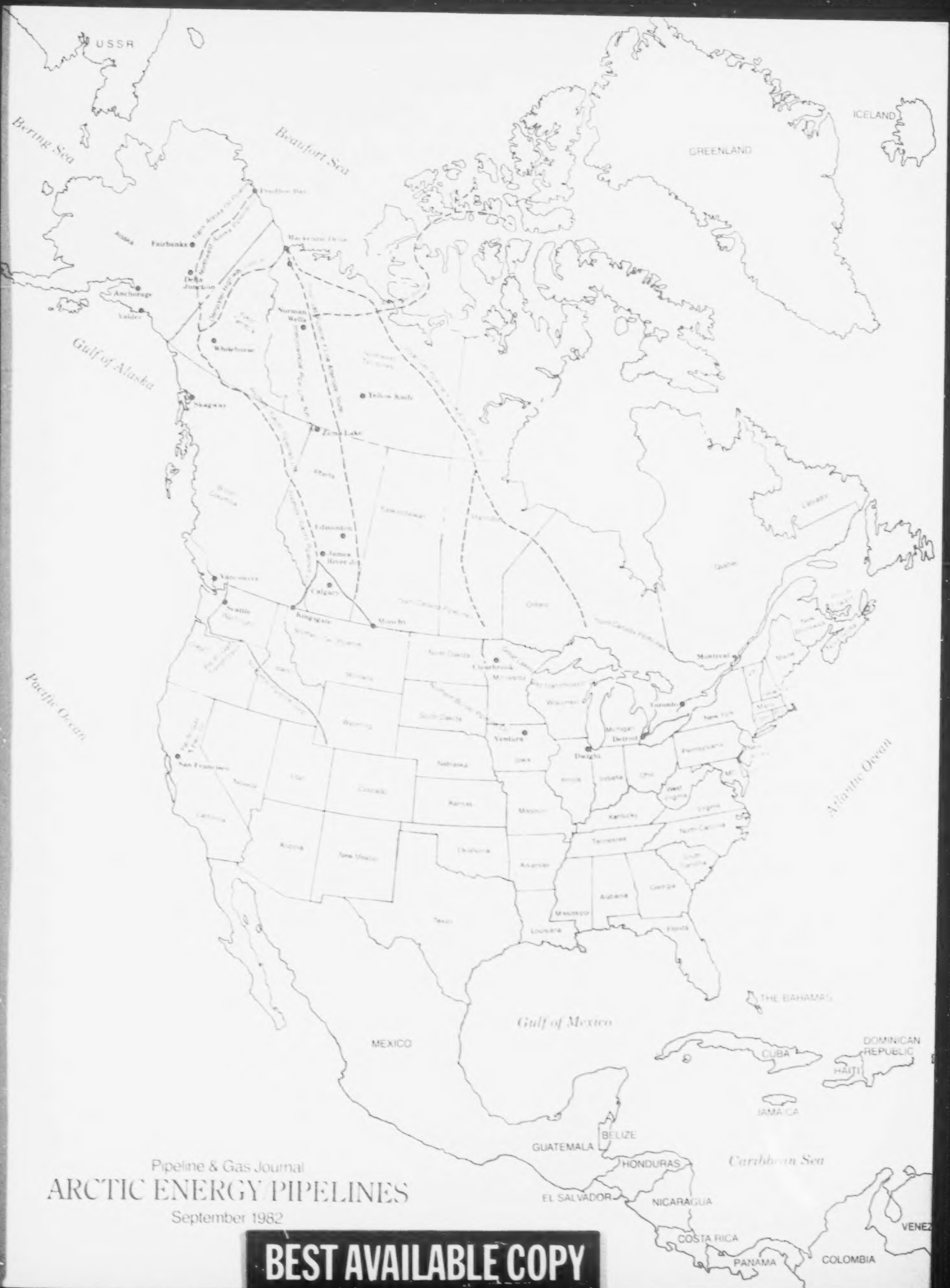
Finally, most of the preliminary field work and design has been completed. Construction planning was well underway when the delay was instituted. Both major contractors – Fluor and Parsons – have greatly reduced their staffs, as has Northwest Alaskan Pipeline in Alaska. Toughest task in the future may be finding qualified personnel to replace those specialized teams of experts.

Other Alaskan Developments

Well over 225 miles of pipelines will be installed on the North Slope during 1982 and 1983 – about one-half of that total during each year. It is all part of a five-year, $10.5-billion program by Sohio and Arco to maintain output from the field to feed the trans-Alaska oil pipeline. And, for the first time, X-70 pipe is being used.

Biggest development is the Prudhoe Waterflood Project that involves nearly 62 miles of 10 through 40-in. insulated pipeline; water injection into the field eventually will reach 3 million bbl/day, of which 2 million bbl will be seawater and 1 million will be produced water.

Development of the Kuparuk Field, third largest in oil field in North America in terms of reserves, continues and that expansion requires many new pipelines in the form of flowlines, produced water lines, gas lines, etc. Kuparuk will also get a waterflood – a pilot study will go on stream in 1983. A new 24-in. oil pipeline to the TAPS Station No. 1 will also be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ARCTIC ENERGY PIPELINES

September 1982

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Moving Arctic Energy To Market

Status of Projects and Proposals – September 1982

Type	Name	Size and Miles	Location	Status
Oil	Trans-Alaska Oil Pipeline	801 miles, 48-in.	Prudhoe Bay to Valdez	Completed and operating.
Oil	Northern Tier Pipeline Co.	1557 miles, 40 and 42-in.	Port Angeles, Wash. to Clearbrook, Minn.	Federal approval and all state approvals but Washington received; new management to continue project.
Oil	Interprovincial Pipe Line (NW) Ltd.	540 miles, 12-in.	Norman Wells, N.W.T., to Northern Alberta	Approved by NEB, but delayed until 1985.
Gas	ALASKA HIGHWAY GAS PIPELINE PROJECT			
	Northwest Alaskan Pipeline Co.	745 miles, 48-in.	Prudhoe Bay to Alaska-Canada (Yukon) border	Final application for construction certificate made to FERC; delayed two years.
	Foothills Pipe Lines (South Yukon) Ltd.	232 miles, 48-in. 276 miles, 56-in.	Southern Yukon	Expect Canadian federal approval when Alaskan section is approved.
	Foothills Pipe Lines (North B.C.) Ltd.	444 miles, 56-in.	Northern British Columbia	Expect Canadian federal approval when Alaskan section in approved.
	Foothills Pipe Lines (Alberta) Ltd.	394 miles, 56-in.	Alberta	Expect Canadian federal approval when Alaskan section is approved.
	Foothills Pipe Lines (Alberta) Ltd.	● 187 miles, 36-in. ● 234 miles, 42-in.	Alberta	Prebuild section. Construction complete.
	Foothills Pipe Lines	105 miles, 36-in.	Southeastern B.C.	Approved. Construction complete on 55 miles.
	Foothills Pipe Lines (Saskatchewan) Ltd.	● 161 miles, 42-in.	Saskatchewan	Completed.
	Northern Border Pipeline Co.	● 823 miles, 42-in.	Monchy, Sask. to Ventura, Iowa	Completed; operational in October 1982.
	Pacific Gas Transmission Co.	● 160.5 miles, 42-in. in four loops	Idaho, Washington, Oregon	Construction completed; operational in October 1981.
	Pacific Gas Transmission Co. and Pacific Gas & Electric Co.	721 miles, 42-in.		Awaiting FERC approval.
	Northwest Pipeline Co.	● 100 miles, 30-in. ● 251 miles, 24-in.	Oregon, Idaho	Loop on existing system; construction completed; operational October 1981.
	Foothills Pipe Lines	740 miles, 34-in.	Near Whitehorse to Mackenzie Delta area	Proposed; estimated cost $2.5 billion (as of June, 1979).
Gas	POLAR GAS PROJECT	3100 miles, 30, 36, 42-in.	High Arctic Islands and Mackenzie Delta to southern Canada	Project plans to file new application with National Energy Board.

● Completed project   Partially completed project

built in the future – with the recently built 16-in. oil line to be converted to natural gas.

More development on the North Slope can be expected. Sohio holds leases west of Arco in the Kuparuk Field area and activity is expected to increase there. More exploration and development drilling in the Beaufort Sea is also foreseen; success depends on the ability to hold down costs. A major push will result from extension of the drilling season to 10 months (prohibited in September and October to accommodate the whales in the region).

Oil Line To Beaufort Sea?

Esso's Interprovincial Pipe Line Co. Ltd. reportedly is considering a 500-mile extension from Norman Wells to the Beaufort Sea area of the 540-mile, 12-in. line it will build in 1985 from Norman Wells to Zama Lake in northern Alberta. Pipeline would be cheaper than tanker transportation from the area. Line will be needed somewhere between 1985 and 1990.

Polar Gas Project

Latest planning on the Polar Gas Project, to deliver some 3.3 Bcf of gas per day to southern Ontario, considers several alernative routes to move the gas to market – one plan to pipeline the gas to Alberta-Saskatchewan border connection with TransCanada PipeLines system – another to make connections with TCPL at points much further east. Polar Gas, like the Alaskan gas pipeline, continues to be delayed because of soft market conditions, a tough money market, and need to develop greater reserves to insure viability of the project.

Arctic Pilot Project

Sponsors of the Arctic Pilot project have deferred the project indefinitely. APP's plan for full commercial operation of LNG tanker transportation of gas from the High Arctic Islands to European and eastern Canada customers by 1992 is now up in the air. Established reserves in the Arctic Islands are calculated at 16 Tcf; the APP would draw from 2.4 Tcf in the Drake Point Field on Melville Island. Sponsors originally hoped for NEB approval by late 1982 so that detailed engineering could begin in 1893 and construction in 1984 with completion set for 1987.

Recently discussions with French and West German officials had convinced APP officials that markets existed in European for the Arctic gas in LNG form. Plans for an LNG regasification terminal in eastern Canada would be shelved and all LNG delivered to Europe. Eastern Canada reportedly feels that its market for natural gas can be adequately supplied from gas from Canada's east coast, namely the Sable Island discoveries off Nova Scotia.

Northern Tier Project

Status of the Northern Tier Pipeline, the 1550-mile, 42-in. line from the Seattle area eastward to Clearbrook, Minn. is expected to change under the project's new management. Getty Oil Co. in June acquired approximately two-thirds of the proposed pipeline interests and announced plans to increase efforts to obtain critical state permits from the state of Washington. The project has been cleared for construction elsewhere.

P&GJ

Second Quarter Report

Earnings drop with lower crude prices

by Cindy Mays, *Assistant Editor*
Energy Management Report

Once again, sagging crude oil prices resulted in a decline in earnings for the oil industry in general during the second quarter. Being locked into buying expensive Saudi Arabian oil, however, proved even more costly to Aramco partners Exxon, Texaco, Socal, and Mobil.

Second quarter earnings of 80 companies responding to our survey dropped 15.6 percent from the same period in 1981. Profit margin for the group fell from 4.8 percent to 3.6 percent.

Even though oil prices dropped, Saudi Arabia held firm to its $34 bbl benchmark price, making it extremely difficult for the Aramco partners to recover their costs through refined products. As a result, Socal's earnings were down 57 percent, Mobil, 56 percent, Exxon 52 percent, and Texaco, 44 percent.

Atlantic Richfield, on the other hand, reported a two percent increase in net income, due primarily to improved performance from the Alaska Kuparak River field, higher crude oil production, cost cutting measures, and higher prices for natural gas.

Increased Alaskan production also helped Standard Oil (Ohio), whose earnings dropped a meager 1.1 percent.

Improved domestic refining and marketing operations were partially offset by increased dry hole and exploration expenses and high interest costs resulting in a five percent drop by Union Oil of California.

Higher production from Shell's Kernridge properties in California and from leases in the Gulf of Mexico kept the company's earnings decline down to seven percent.

Heavy losses in Occidental Petroleum's oil and gas division resulted in a 52 percent decrease in second quarter earnings.

Ashland Petroleum's focus on domestic crude oil for an increasing share of its raw material supplies contributed to their 741 percent increase in earnings.

Lower raw material costs and increased refining margins helped Amerada Hess boost their net income 13.7 percent.

Phillips Petroleum reported a 39.1 percent decrease in earnings due to lower worldwide crude oil and natural gas liquids production, lower U.S. natural gas production, and higher exploration costs.

Weak oil markets and competitive pressure resulted in a 32.5 percent drop in earnings for Gulf Oil.

Higher exploration and interest costs coupled with lower profit margins for natural gas liquids and refined petroleum products drove Cities Service earnings down 27 percent.

Sun Co.'s net income declined 32.5 percent following low crude prices and operating problems.

Increased foreign and domestic exploration and production costs, as well as lower crude oil, condensate, and liquid natural gas prices contributed to Getty Oil's 26.1 percent earnings drop.

(Continued)

GAS COMPANIES SECOND QUARTER FINANCIAL REPORTS

	Three months ending June 30**						Six months ending June 30**						Profit‡ Margin	
	Revenues ($000)			Earnings* ($000)			Revenues ($000)			Earnings* ($000)				
Company	1982	1981	% Chg.	1982	1981	% Chg.	1982	1981	% Chg.	1982	1981	% Chg.	1982	1981
Alabama Tennessee N.G.	29,741	27,065	+ 9.9	1,316	1,313	+ 0.2	67,014	61,129	+ 9.6	2,987	2,951	+ 1.2	4.5	4.8
American Nat. Resources	683,386	590,044	+ 15.8	15,681	15,660	+ 0.1	163,045[3]	114,975[3]	+ 41.8	165,455[3]	134,354[3]	+ 23.1	1.5	16.9
Arkla Inc	307,021	302,421	+ 1.5	26,998	32,602	- 17.2	1,242,809[3]	1,088,217[3]	+ 14.2	93,283[3]	82,185[3]	+ 13.5	7.5	7.6
Columbia Gas	994,259	889,936	+ 11.7	31,256	32,691	- 4.4	2,869,815	2,361,489	+ 21.5	135,219	119,060	+ 13.6	4.7	5.0
Consolidated N.G.	628,728	524,518	+ 19.9	25,273	22,171	+ 14.0	1,829.179	1,567,560	+ 16.7	111,872	93,389	+ 19.8	6.1	6.0
El Paso Companies	956,439	910,869	+ 5.0	18,197	37,772	- 51.8	1,890,386	1,819,164	+ 3.9	39,389	68,676	- 42.6	2.1	3.8
ENSERCH Corp.	901,465	821,566	+ 10.0	36,065	46,197	- 22.0	1,905,925	1,656,408	+ 15.0	93,253	102,120	- 9.0	4.9	6.2
InterNorth	721,377	737,980	- 2.2	21,952	39,305	- 44.1	2,174,210	1,880,595	+ 15.6	128,096	155,667	- 17.7	5.9	8.3
Kansas-Nebraska N.G.	98,848	87,967	+ 12.4	2,738	2,284	+ 19.9	490,374[3]	406,434[3]	+ 20.7	27,222[3]	23,187[3]	+ 17.4	5.5	5.7
Mountain Fuel Supply	306,382	260,301	+ 17.7	34,300	21,743	+ 57.8	531,032[3]	441,350[3]	+ 20.3	31,328[3]	30,424[3]	+ 3.0	5.9	6.9
National Fuel Gas	851,208	755,137	+ 12.7	39,162	38,634	+ 1.4	984,527[3]	852,920[3]	+ 15.4	33,610[3]	33,228[3]	+ 1.2	3.4	3.9
Northwest Energy	302,461	287,177	+ 5.3	1,765	14,169	- 87.5	793,424	715,878	+ 10.8	32,917	37,166	- 11.4	4.1	5.2
ONEOK Inc.	252,537	261,049	- 3.3	10,840	13,899	- 22.0	626,440	594,926	+ 5.3	33,307	36,751	- 9.4	5.3	6.2
Pacific Lighting	1,006,727	803,948	+ 25.2	33,968	33,596	+ 1.1	3,990,896[3]	3,093,247[3]	+ 29.0	113,111[3]	135,703	- 16.6	2.8	4.4
Panhandle Eastern	793,899	845,501	- 6.1	62,603	78,960	- 20.7	1,752,492	1,721,179	+ 1.8	135,964	156,759	- 13.3	7.8	9.1
Pioneer Corp.	254,806	308,022	- 17.3	(13,064)	28,402		557,219	596,177	- 6.5	16,779	57,599	- 70.9	3.0	9.7
Sonat Inc.	611,371	623,444	- 1.9	49,137	40,695	+ 20.7	1,427,044	1,302,064	+ 9.6	112,336	90,820	+ 23.7	7.9	7.0
Southern Union Co.	249,416	239,173	+ 4.3	2,287	8,911	- 74.3	1,068,050[3]	1,039,905[3]	+ 2.7	24,727[3]	41,344[3]	- 40.2	2.3	4.0
Texas Eastern Corp.	1,412,034	1,017,967	+ 38.7	42,752	60,032	- 28.8	2,836,622	2,172,514	+ 30.6	104,677	122,640	- 14.6	3.7	5.6
Texas Gas Transmission	673,294	590,366	+ 14.0	28,422	34,200	- 16.9	1,456,558	1,273,530	+ 14.4	58,213	69,841	- 16.6	4.0	5.5
Texas Oil & Gas	503,970	415,606	+ 21.3	63,308	50,570	+ 25.2	1,420,046[2]	1,149,402[2]	+ 23.5	179,618[2]	138,809[2]	+ 29.4	12,6	12.1
Transco Energy Co.	964,117	919,735	+ 4.8	41,793	31,085	+ 34.4	1,880,775	1,770,568	+ 6.2	77,855	62,471	+ 24.6	4.2	3.5
Union Gas Ltd.	208,840	178,036	+ 17.3	5,465	5,110	+ 6.9								
United Energy Resources	1,377,883	1,274,871	+ 8.1	54,249	53,908	+ 0.6	5,850,431[3]	4,707,209[3]	+ 24.3	224,835[3]	195,968[3]	+ 14.7	3.8	4.2
Westcoast Transmission[1]	215,591	274,994	- 21.6	18,212	16,951	+ 7.4	639,865	646,893	- 1.1	37,746	33,663	+ 12.1	5.9	5.2
TOTAL	15,305,810	13,947,693	+.097	654,675	760,860	- 14.0	38,448,178	31,760,203	+ 21.1	2,013,799	2,024,775	- 0.5	5.2	6.4

*Earnings available to common. **Excluding non-recurring items. ‡Earnings* divided by Revenues.
[1] Three months ending May 31. [2] Nine months. [3] Twelve months.

OIL COMPANIES SECOND QUARTER FINANCIAL REPORTS

		Three months ending June 30*						Six months ending June 30**						Profit‡ Margin	
		Revenues ($000)			Earnings* ($000)			Revenues ($000)			Earnings* ($000)				
		1982	1981	% Chg.	1982	1981	% Chg.	1982	1981	% Chg.	1982	1981	% Chg.	1982	1981
1.	Adams Resources & Energy	63,336	53,435	+ 18.5	1,167	(3,231)		114,696	119,174	- 3.8	185	(5,525)		0.2	
2.	Adobe Oil & Gas Corp.	49,878	44,685	+ 11.6	5,828	6,432	- 9.4	103,742	85,104	+ 21.9	11,729	11,940	- 1.8	11.3	14.0
3.	Altex Oil	1,640	1,367	+ 20.0	30	160	- 81.2	4,799[3]	4,034[3]	+ 19.0	186[3]	764[3]	- 75.6	3.9	18.9
4.	Amarex Inc.[1]	13,871	8,800	+ 57.6	410	1,426	- 71.2	28,930	15,830	+ 82.8	1,701	2,146	- 20.7	5.9	13.6
5.	Amerada Hess	1,780,361	2,231,821	- 20.2	61,086	53,716	+ 13.7	4,153,577	5,201,036	- 20.1	44,922	120,820	- 62.8	1.1	2.3
6.	American Pacific	4,601	2,816	+ 63.4	(414)	(542)		10,041[3]	7,672[3]	+ 30.9	1,798[3]	736[3]	+ 144.3	17.9	9.6
7.	American Petrofina	607,993	713,724	- 14.8	10,875	15,251	- 28.7	1,183,207	1,380,198	- 14.3	26,870	35,501	- 24.3	2.3	2.6
8.	Argonaut Energy[2]	7,632	5,383	+ 41.8	(187)	322		1,762	2,737	- 35.6	(69)	155			5.7
9.	Argo Petroleum	5,337	5,832	- 8.5	(1,745)	731		11,029	11,154	- 1.1	(2,338)	1,518			13.6
10.	Ashland Oil	2,217,695	2,516,913	- 11.9	63,756	7,576	+741.6	4,430,846	4,883,005	- 9.3	46,668	9,015	+ 417.7	1.1	0.2
11.	Asamera	100,809	105,410	- 4.4	(498)	546		207,230	218,820	- 5.3	(1,844)	4,150			1.9
12.	Atlantic Richfield	6,808,877	6,968,034	- 2.3	409,778	339,616	+ 2.5	13,236,033	14,100,354	- 6.1	795,187	767,940	+ 3.5	6.0	5.4
13.	Beard Oil	9,724	9,216	+ 5.5	206	1,416	- 85.4	18,833	16,267	+ 15.8	635	2,495	- 74.5	3.4	15.3
14.	Belco Petroleum	80,055	79,574	+ 0.6	24,307	23,269	+ 4.5	161,685	157,311	+ 2.8	51,035	47,896	+ 6.6	31.6	30.4
15.	Brock Exploration[5]	1,459	1,296	+ 12.6	(371)	(232)									
16.	Buttes Gas & Oil	29,602	32,204	- 8.1	(1,322)	(2,517)		83,727	69,834	+ 19.9	740	426	+ 73.7	0.9	0.6
17.	Cities Service	2,178,900	2,177,500	+ 0.1	74,400	102,000	- 27.1	4,456,300	4,376,400	+ 1.8	127,700	168,200	- 24.1	2.9	3.8
18.	Consolidated O&G	8,660	11,229	- 21.9	(140)	1,711		21,556	24,350	- 11.5	(2,312)	3,693			15.2
19.	Crown Central	421,368	380,785	+ 10.7	2,901	3,915	- 25.9	839,634	758,613	+ 10.7	(5,947)	6,313			0.8
20.	Crystal Oil	45,099	75,806	- 40.5	(1,119)	1,598		106,126	145,152	- 26.9	(1,902)	25			
21.	Diamond Shamrock	857,709	810,448	+ 5.8	31,926	55,248	- 42.2	1,648,844	1,683,098	- 2.0	61,075	116,022	- 47.4	3.7	6.9
22.	Discovery Oil	1,414	1,893	- 25.3	(411)	258		2,381	3,899	- 38.9	(646)	575			14.8
23.	Dorchester Gas[2]	376,224	166,418	+ 126.1	4,340	7,583	- 42.8	805,530[3]	481,191[3]	+ 67.4	13,778[3]	23,583[3]	- 41.6	1.7	4.9
24.	Eagle Exploration[5]	476	203	+ 136.0	(525)	(70)									
25.	Enstar Corp.	88,059	85,241	+ 3.3	8,976	6,284	+ 42.8	179,507	171,608	+ 4.6	19,517	24,230	- 19.5	10.9	14.1
26.	Equity Oil	5,739	6,835	- 16.0	467	1,736	- 73.1	11,757	12,441	- 5.5	1,706	2,887	- 40.9	14.5	23.2
27.	Felmont	21,199	17,178	- 123.4	4,269	3,297	+ 29.5	39,227	36,225	+ 8.3	7,133	8,634	- 17.4	18.2	23.8
28.	Forest Oil Corp.	36,792	34,900	+ 5.4	1,815	946	+ 91.9	75,861	65,994	+ 15.0	5,240	3,228	+ 62.3	6.9	5.0
29.	Getty Oil	3,078,275	3,216,549	- 4.3	151,263	204,775	- 26.1	6,202,852	6,511,170	- 4.7	314,909	434,705	- 27.6	5.1	6.7
30.	Gulf Energy & Develop.	18,800	14,112	+ 33.2	1,054	1,726	- 38.9	34,174	28,181	+ 21.3	1,488	3,289	- 54.8	4.4	11.7
31.	Gulf Oil Corp.	7,426,000	7,206,000	+ 3.1	210,000	311,000	- 32.5	14,965,000	15,807,000	- 5.3	477,000	614,000	- 22.3	3.2	3.9
32.	Hershey Oil	1,824	1,177	+ 55.0	126	214	- 41.1	3,610	2,752	+ 31.2	351	672	- 47.8	9.7	24.4
33.	Holly Corp.[6]	134,018	93,725	+ 43.0	1,427	382	+273.6	218,478	190,129	+ 48.0	7,221	1,769	+ 308.2	2.6	0.9
34.	Howell Corp	63,924	56,377	+ 13.4	759,000	270,000	+118.1	130,762	104,106	+ 25.6	1,553	915	+ 69.7	1.2	0.9
35.	Howell Petroleum	20,883	22,650	- 7.8	2,472	1,749	+ 41.3	43,697	44,829	- 2.5	4,514	3,568	+ 26.5	10.3	8.0
36.	Inexco Oil	55,699	61,694	- 9.7	4,418	8,447	- 47.7	118,526	114,592	+ 3.4	12,025	14,792	- 18.7	10.1	12.9
37.	KRM	1,309	1,382	- 5.3	35	244	- 85.7	2,679	2,734	- 2.0	165	498	- 66.9	6.2	18.2
38.	Kerr-McGee Corp.	911,850	890,812	+ 2.4	50,235	51,445	- 2.4	1,848,505	1,806,938	+ 2.3	79,404	94,782	- 16.2	4.3	5.2
39.	Lear Petroleum	48,221	38,903	+ 24.0	498	356	+ 39.9	102,927	77,963	+ 32.0	(1,267)	3,441			4.4
40.	Mapco Inc.	481,841	505,373	- 4.7	17,878	29,009	- 38.4	962,677	1,085,394	- 11.3	33,891	54,444	- 37.8	3.5	5.0
41.	May Petroleum	7,765	10,494	- 26.0	(2,269)	1,922		15,479	19,751	- 21.6	(3,418)	4,562			23.1
42.	Maynard Oil	8,144	11,015	- 26.1	(1,665)	1,613		19,482	20,997	- 7.2	(649)	3,929			18.7
43.	McFarland Energy	3,701	3,826	- 3.3	793	1,154	- 31.3	7,460	7,811	- 4.5	1,779	2,239	- 23.6	23.9	29.8
44.	Mesa Petroleum	99,820	100,911	- 1.1	35,880	26,074	+ 37.6	203,959	204,535	- 0.3	69,109	55,915	+ 23.6	33.9	27.3
45.	Mobil Corp.	15,800	16,600	- 5.0	310,000	700,000	- 56.0	32,200,000	33,700,000	- 4.0	636,000	1,340,000	- 53.0	2.0	4.0
46.	Moran Energy	24,330	24,831	- 2.0	1,825	4,559	- 60.0	53,389	48,959	+ 9.0	5,908	9,915	- 40.4	11.1	20.3
47.	Murphy Oil	598,551	660,021	- 9.3	41,705	44,995	- 7.3	1,342,907	1,326,827	+ 1.2	74,083	83,425	- 10.0	5.6	6.3
48.	Natomas	405,670	370,276	+ 9.6	46,330	57,557	- 19.5	795,299	735,706	+ 8.1	96,184	115,794	- 16.9	12.1	15.7
49.	Noble Affiliates	107,6[illegible]	93,402	+ 15.3	20,247	18,341	+ 10.4	222,372	180,905	+ 22.9	42,685	36,391	+ 17.3	19.2	20.1
50.	Norris Oil	6[illegible]	812	- 18.5	(154)	15		1,337	1,330	+ 0.5	54	23	+ 134.8	4.0	1.7
51.	Oxoco	8,854	5,023	+ 76.3	1,741	1,184	- 47.0	16,356	8,764	+ 86.6	3,432	1,659	+ 106.9	21.0	18.9
52.	Pennzoil Co.	588,689	672,115	- 12.4	44,776	59,085	- 24.2	1,175,865	1,360,103	- 13.5	84,729	119,319	- 29.0	7.2	8.8
53.	Phillips Petroleum	4,029,817	4,072,955	- 1.1	139,921	229,767	- 39.1	7,842,839	8,301,424	- 5.5	328,735	500,551	- 34.3	4.2	6.0
54.	Prairie Producing Co.	6,401	8,037	- 20.4	2,380	4,760	- 50.0	13,531	14,557	- 7.0	1,083	1,609	- 32.7	8.0	11.0
55.	Quarker State	251,368	226,221	+ 11.1	14,011	7,367	+ 90.2	476,631	445,655	+ 7.0	19,835	11,003	+ 80.3	4.2	2.5
56.	Sabine Corp.	48,658	42,992	+ 13.2	7,667	7,422	+ 3.3	96,538	85,435	+ 13.0	13,393	16,035	- 16.5	13.9	18.8
57.	Seneca Oil	5,642	2,649	+ 113.0	(1,102)	132		16,120[3]	8,491[3]	+ 89.9	(1,629)[3]	1,516[3]			17.9
58.	Shell Oil	5,105,000	5,554,000	- 8.1	380,000	410,000	- 7.3	9,947,000	10,967,000	- 9.3	724,000	771,000	- 6.0	7.3	7.0
59.	Southland Royalty	92,910	104,647	- 11.2	8,193	10,423	- 21.4	187,748	200,327	- 6.3	16,789	20,410	- 17.7	8.9	10.2
60.	Southwestern Energy	12,859	11,026	+ 16.6	2,517	2,335	+ 7.8	33,870	32,033	+ 5.7	6,831	7,853	- 13.0	20.2	24.5
61.	Standard California	9,370,000	10,979,000	- 14.7	263,000	616,000	- 57.3	19,390,000	22,967,000	- 15.6	493,000	1,282,000	- 61.5	2.5	5.6
62.	Statex Petroleum	3,710	2,336	+ 58.8	786	333	+ 13.6	7,078	4,840	+ 46.2	1,367	922	+ 48.3	19.3	19.0
63.	Sun Co.	4,000,000	3,648,000	+ 9.7	110,000	163,000	- 32.5	8,000,000	7,648,000	+ 4.6	234,000	283,000	- 17.3	2.9	3.7
64.	Sundance Oil	27,750	7,524	+ 268.8	1,487	600	+147.8	51,114	13,774	+271.1	1,700	(3,288)		3.3	
65.	Superior Oil	505,887	504,181	+ 0.3	74,407	99,295	- 25.1	1,036,571	997,087	+ 4.0	155,708	207,255	- 24.9	15.0	20.8
66.	Tenneco	3,735,000	3,742,000	- 0.2	188.492	187,614	+ 0.5	7,549,000	7,518,000	+ 0.4	301,877	365,626	- 17.4	4.0	4.9
67.	Tesoro Petroleum	556,314	655,242	- 15.1	15,500	15,721	- 1.4	1,806,153	2,345,813	- 23.0	34,865	62,035	- 43.8	1.9	2.6
68.	Texaco Inc.	11,500,000	14,800,000	- 22.3	305,000	556,000	- 45.1	24,500,000	30,300,000	- 19.1	672,000	1,214,000	- 44.6	2.7	4.0
69.	Texas American	45,121	55,156	- 18.2	(1,833)	(940)		114,834	136,454	- 15.9	169	298	- 43.3	0.1	0.2
70.	Texas International	45,655	37,168	+ 22.8	3,663	4,334	- 15.5	90,432	70,896	+ 27.6	6,959	6,188	+ 12.5	7.7	8.7
71.	Tomlinson Oil[2]	23,154	37,857	- 38.8	(1,249)	(2,093)		74,295[3]	104,526[3]	- 28.9	(3,727)[3]	(2,852)[3]			
72.	Transcontinental Energy	15,191	23,977	- 36.6	(2,380)	2,981		35,138	46,421	- 24.3	(3,018)	5,037			10.9
73.	Tribune Oil	557	657	- 15.2	165	208	- 20.7	1,126	1,220	- 7.7	346	372	- 7.1	30.7	30.5
74.	Union California	2,909,700	2,799,700	- 4.0	197,600	207,900	- 5.0	5,391,300	5,476,500	- 1.6	336,100	362,400	+ 1.0	6.8	6.6
75.	Universal Resources	14,507	15,442	- 6.1	2,222	3,513	- 36.8	31,592	29,587	+ 6.8	5,230	6,321	- 17.3	16.6	21.4
76.	Wainoco Oil	12,312	9,905	+ 24.3	(3,661)	125		25,910	20,206	+ 28.2	(6,407)	1,138			5.6
77.	Wilshire Oil of TX	3,315	4,022	- 17.6	2,442	1,402	+ 74.2	6,342	7,489	- 15.30	4,114	2,205	+ 86.6	64.9	29.4
78.	Wiser Oil	13,040	16,527	- 21.1	3,702	4,253	- 13.0	27,840	33,166	- 16.1	7,344	8,990	- 18.3	26.4	27.1
79.	Woods Petroleum	20,836	16,055	+ 30.0	5,903	4,074	+ 44.9	41,168	32,432	+ 26.9	11,670	8,741	+ 33.5	28.4	27.0
80.	Worldwide Energy	12,225	13,031	- 6.2	360	368	- 2.2	26,370	25,661	+ 2.8	650	433	+ 50.1	2.5	1.7
TOTAL		72,854,625	78,556,417	- 7.3	4,133,634	4,896,935	- 15.6	180,616,783	196,279,984	- 0.8	6,544,111	9,499,410	- 31.1	3.6	4.8

** Excluding non-recurring items. *Earnings available to common stock. ‡Earnings* divided by Revenues. [1] Ends April 30. [2] Ends May 31.
[5] Ends March 31. [6] Ends January 31. [3] Nine months. [4] Twelve months. ( ) Loss.

Diamond Shamrock's second quarter earnings decreased 42.2 percent due to prolonged impact of the recession on the company's chemical operations.

Dorchester Gas net income fell 42.8 percent as a result of higher net interest cost and lower average liquid natural gas prices.

Southland Royalty reported a 21 percent decline in earnings because of lower crude oil prices.

The combination of higher selling prices for gasoline and fuel oils and the effects of cost controls gave Quaker State Oil Refining a 90.2 percent increase in net income.

The 25 gas companies responding to our survey posted a 14 percent decline in net earnings for the second quarter. Profit margin for the group fell from 6.4 percent to 5.2 percent.

A substantial increase in earnings from The El Paso Company's exploration and production activities were more than offset by the adverse effects of reduced margins and sales volumes of chemical products and higher interest expense. A reduction in gas market demand also contributed to the company's 51.8 percent decline in net income.

Southern Union reported a 74.3 percent decrease in earnings due to low demand and weak prices.

Columbia Gas System's earnings were adversely affected by higher natural gas rates on the company's markets and lower gas production.

The start-up of the 285-mile interstate Ozark Gas Transmission System helped Texas Oil & Gas post a 25.2 percent second quarter gain.

FINANCIAL NOTEBOOK

Mergers/acquisitions. Santa Fe International will acquire Andover Oil (Tulsa) for about $150 million. The privately held oil/gas exploration company had revenues of $78 million last year.

American Public Energy will merge into subsidiary, Amquest Corp.

Gulf Energy & Development purchased all Pano Tech Exploration (Houston) outstanding stock.

Diamond Shamrock agreed to acquire Sigmor Corp. (San Antonio) for about $160 million. Deal includes Sigmor's petroleum refinery, about 600 retail gasoline stations, a crude oil and refined products pipeline network, and a pipe distribution company.

Callon Petroleum agreed to purchase Amwar Petroleum (Oklahoma City) for 300,000 common shares and up to 200,000 shares payable in 1985.

Contracts. C-E Natco (Combustion Engineering) received $2.5 million in orders from Getty Oil for offshore production processing equipment and steam generation units for use in enhanced oil recovery.

Pe Ben Oilfield services received a subcontract from Pe Ben Pipelines on a gas pipeline looping project for Union Gas Ltd. of Toronto.

Defense Logistics Agency awarded contracts to: Exxon International, $203.4 million for jet fuel and gasoline; Puerto Rico Sun Oil, $21.8 million for marine diesel fuel; L.A. Swann Oil, $10.2 million for burner oil.

Money markets. Blocker Energy agreed to restructure $160 million of secured debt under a long-term credit agreement with a group of eight domestic and international banks due to a $21 million second quarter write-down on all its oil/gas properties.

H&H Tool plans to purchase up to 100,000 of its common shares on the open market.

Transco Energy's Transcontinental Gas Pipe Line unit plans to file for the sale of $75 million in intermediate-term debentures.

Wyoming Interstate (Coastal Corp.) completed project financing arrangements for its 269-mile central segment of the Trailblazer Pipeline System.

Standard Oil (Ohio) guaranteed the $171 million of newly acquired Kennecott Corp.'s 7⅞ debentures outstanding.

Exploration pacts. Husky Oil Operations, Bow Valley Industries, and Petro-Canada received permits to explore for oil/gas for three years on 4.2 million acres offshore Sable Island, Nova Scotia.

Petro-Canada International Assistance and Petroleum Corporation of Jamaica signed an agreement under which Canadian companies will provide equipment and technology to Jamaica for onshore drilling operations and assessment of the country's onshore and offshore oil/gas potential through surveys.

Natomas Petroleum (Bahamas) and BP Petroleum Development were awarded two petroleum licenses by the Commonwealth of the Bahamas.

Amoco Morocco Oil (Standard Oil Indiana) and the Moroccan government signed an agreement for oil/gas exploration off the Mediterranean coast of that country.

Irish government awarded an exploration license for three offshore blocks off Southern Ireland in the Celtic Sea to Diamond Shamrock, Total Marine Ireland, Weeks International, Clyde Petroleum, Bow Valley Industries, and Gaelic Oil.

Projects. Suncor plans to upgrade its Sarnia, Ontario refinery for $335 million to reduce its crude oil requirements to 50,000 b/d from 76,100 b/d in 1981 and more than double production of gasoline and diesel oil to about 80% of capacity.

Joint ventures. A.B.C. Energy (Toronto) entered into a joint venture with Energy Associates (Wichita, KS) to participate in a working interest in Pennsylvania's Parker Field.

Briefs. Standard Oil (Ohio) formed an operating company, Sohio Oil to include all downstream petroleum activities including crude trading and transportation, petroleum products and refining, retail marketing, and wholesale marketing and distribution.

Dome Petroleum (Calgary) is cutting its U.S. workforce of about 245 down by 25% percent.

Mitchell Energy & Development acquired additional working interests in about 100 producing oil/gas wells in North Texas from Now Petroleum (Miles Production) and two limited partnerships.

Co-operative Energy Corp. was formed by Canadian government and 20 financial agriculture, service, and marketing co-operatives to explore for oil/gas.

An American and Canadian consortium started drilling for oil offshore Guyana last month. ■

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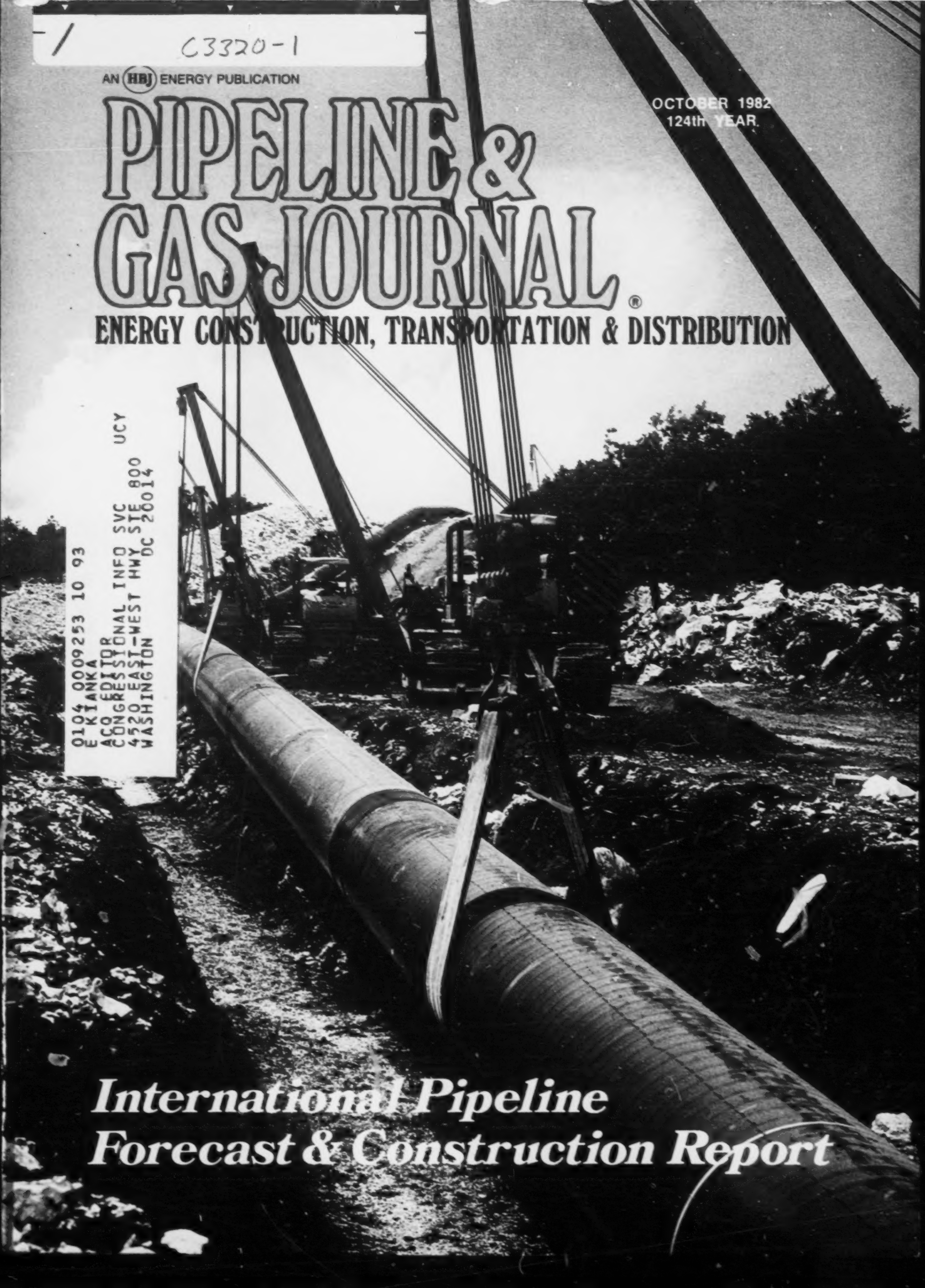

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COVER
Construction of the Trans-Mediterranean Pipeline's 48-in. gas line across Italy from South to North continues in the central section near Rome; line will now be completed as a 48-in. instead of 42-in. in northern section.

—photo courtesy Saipem S.p.A.

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Santos' 411-Mile Liquids Line Will Be Operational In December 100
New outlet for crude oil, gas liquids from Cooper Basin fields – line from Moomba to Stony Point – completed in less than one year.

World Pipeline Plans Total Over 100,000 Miles, $146 Billion

by **Dean Hale**, *Editor*

International pipeline construction in 1983 (outside the United States) will require expenditures in excess of $9.5 billion for the installation of over 12,100 miles of natural gas, crude oil, refined products, natural gas liquids, carbon dioxide, and slurry pipelines.

Presently, there are 100,418 miles of all types of pipelines planned or under construction internationally. That includes 80,558 miles of planned or underway lines in the free world and 19,860 miles of planned and underway lines in the U.S.S.R., the eastern bloc countries, and China. Estimated cost of these lines is $146.1 billion.

During 1982, some 13,227 miles of pipelines will be completed worldwide, at a cost of $8.9 billion. Major new pipeline system construction has slowed for a variety of reasons, including lessened economic activity in most areas of the world, an increasing supply of oil and gas that exceeds demand, the high cost of money, and inflationary pressures. Recent armed conflicts in several areas of the world have also

INTERNATIONAL PIPELINE CONSTRUCTION

(As of October 1982)

		Miles	
Type of Line	**Total**	**Underway**	**Planned**
Natural Gas	68,568	10,139	58,429
Crude Oil	17,858	1,794	16,064
Petroleum Products	12,198	1,186	11,012
Slurry	1,794	—	1,794
TOTALS	**100,418**	**13,119**	**87,299**

INTERNATIONAL PIPELINES PLANNED OR UNDER CONSTRUCTION

(as of October 1, 1982)

Area	Gas Pipelines Planned	Gas Pipelines Underway	Gas Pipelines Total	Crude Oil Pipelines Planned	Crude Oil Pipelines Underway	Crude Oil Pipelines Total	Products Pipelines Planned	Products Pipelines Underway	Products Pipelines Total	Slurry Pipelines Planned	Slurry Pipelines Underway	Slurry Pipelines Total	TOTALS Planned	TOTALS Underway	TOTALS Total
Canada	10267	529	10796	1525	0	1525	417	0	417	500	0	500	12709	529	13238
Mexico & Central America	0	68	68	796	78	874	1160	186	1346	—	—	—	1956	332	2288
South America	8899	444	9343	3804	239	4043	1761	125	1886	143	0	143	14607	808	15415
Europe	12411	2888	15299	723	308	1031	507	138	645	—	—	—	13641	3334	16975
Africa & Middle East	7757	2170	9927	5012	1169	6181	4976	0	4976	—	—	—	17745	3339	21084
Southeast Asia, Korea, Japan, Pacific	3942	269	4211	1142	0	1142	964	220	1184	620	0	620	6668	489	7157
Australia & New Zealand	3153	149	3302	157	—	157	236	517	753	189	0	189	3735	666	4401
TOTALS	46429	6517	52946	13159	1794	14953	10021	1186	11207	1452	0	1452	71061	9497	80558
Other (USSR, Eastern Bloc, China)	12000	3622	15622	2905	0	2905	991	0	991	342	0	342	16238	3622	19860
WORLD TOTALS (miles)	58429	10139	68568	16064	1794	17858	11012	1186	12198	1794	0	1794	87299	13119	100418
WORLD TOTALS (km)	93486	16222	109709	25702	2870	28573	17619	1898	19517	2870	0	2780	139678	20990	160669

had a strong effect on planned construction.

For 1983, the outlook is for a continuation of the current construction pace with possibly some acceleration in activity – based on the results of PIPELINE & GAS JOURNAL's survey of world pipeline activity.

During 1982, the P&GJ Survey indicates that 6988 miles of gas transmission, field, and gathering lines will be completed; 4081 miles of crude oil trunk lines and gathering lines; 1626 miles of refined petroleum products and natural gas liquids pipelines, and 532 miles of offshore oil and gas pipelines and gathering lines.

The 1982 total includes continuing work on – and completion of many – projects, both major and minor. Among these are the final sections of British Gas Corp.'s 42-in. Fourth Feeder Line from St. Fergus southward; the central section of the Trans-Mediterranean Pipeline in Italy; 1982 work on the Danish gas transmission system, onshore and offshore; a big chunk of oil and gas lines in Saudi Arabia, Oman, Kuwauit, Abu Dhabi, and other Middle East countries; Australia's 411 miles of liquids line from Moomba to Stony Point, and numerous other projects.

Although many widely publicized major projects have been completed, there remain even more that promise to keep international pipeline construction an exciting business for many years ahead. Of the planned 71,061 miles of free world pipeline projects listed in the P&GJ survey, 65.3% of the mileage is for natural gas lines, 18.5% is for crude oil pipelines, 14.1% is for products pipelines, and 2.1% is for slurry pipelines.

Of the 9497 miles of pipelines under construction, 68.6% are gas pipelines, 18.9% are crude oil lines, and 12.5% are products pipelines.

In the free world, Africa and the Middle East leads the list with a total of 21,084 miles of which 17,745 miles are planned; Europe is in second place, with 16,975 miles total and 13,641 miles planned; South America is a healthy third with 15,415 total miles and 14,607 planned miles; Canada follows in fourth place with 13,238 total miles and 12,709 miles planned. Southeast Asia/Pacific/Orient area has 7157 total miles and 6668 miles planned; Australia and New Zealand total 4401 miles with 3735 planned, and Mexico and Central America report a total of 2288 miles and 1956 miles planned.

The Soviet Union, not including some far-distant multiple 3100-mile large diameter gas pipelines, has a reported 14,070 miles with 10,448 miles planned.

Optimism about the future of international pipeline construction activity is based on the fact that demand worldwide for oil and gas is increasing, and that there have been many significant new oil and gas discoveries around the world – leading to increasing amounts of oil and gas energy that must be moved to consuming markets. Result is that a backlog of new facilities to move this energy has been created and, with improvement in interest rates and economic conditions, will foster a surge of pipeline building activity.

World energy usage is changing, too, as more natural gas is discovered and is being substituted for oil whenever possible. In the energy market, natural gas is highly competitive because it is easier to utilize and easier to handle. Worldwide, some big domestic markets for natural gas will continue to expand. Gas distribution grids are being planned in most countries where they do not exist – and expanded where they do exist.

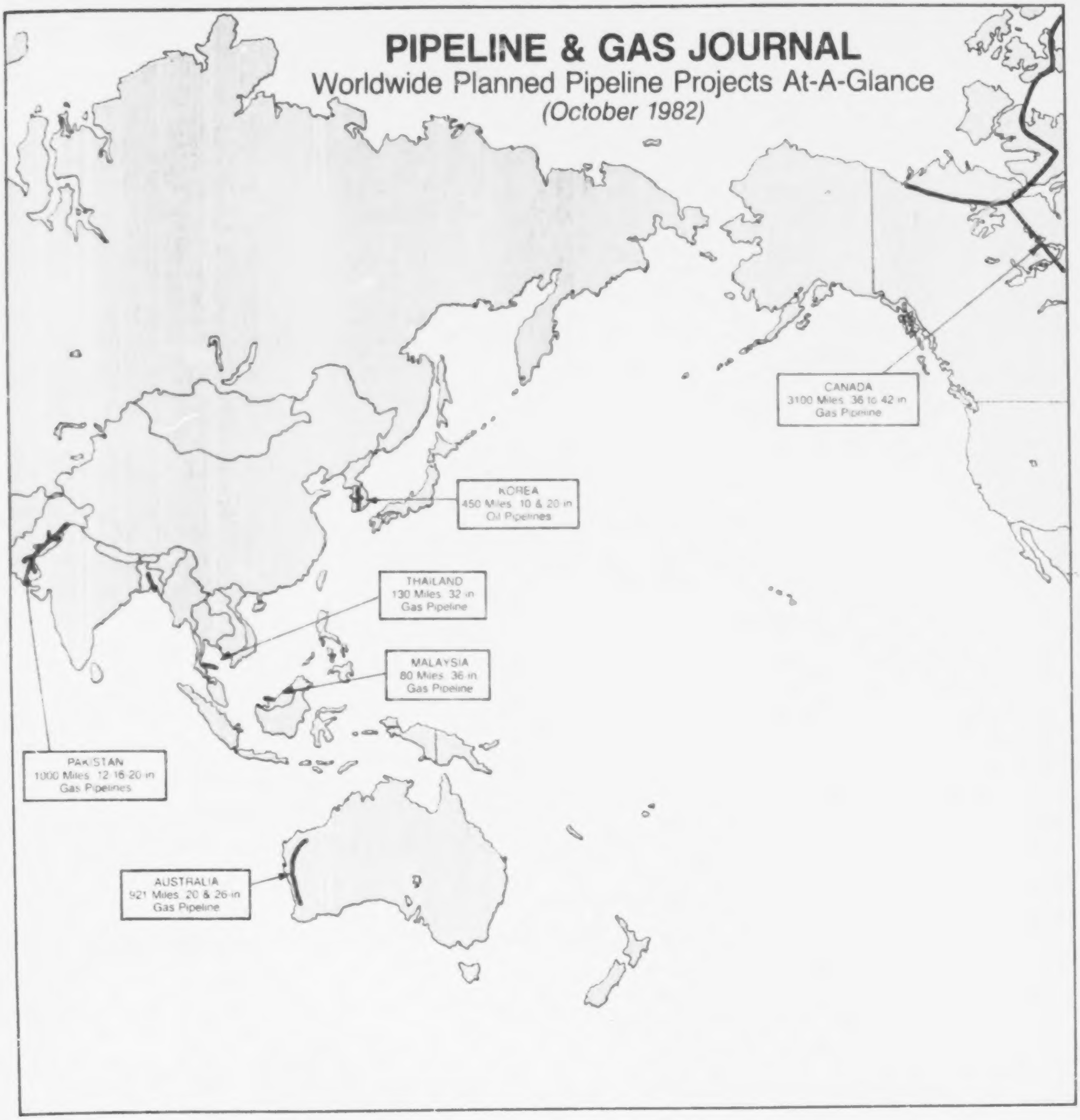
Gas consumption is also expanding in basic industries essential to economic development – such as electric generation, petrochemicals, fertilizers, steel and iron production, cement, and food processing. A recent International Gas Union report says that world gas demand could rise from 1.6 trillion cu m in 1980 to 2.3 trillion cu m in 1990 and 2.76 trillion cu m in the year 2000. An increase in pipeline capacity of 50% to 80% over present capacity will be needed to accommodate that demand. And, IGU says, even at the high production

1982 International Pipeline Construction*

(Estimated Miles Completed During 1982)

Gas Transmission	5688
Gas Field, Gathering	1300
TOTAL	**6988**
Crude Trunk Lines	2536
Crude Gathering	1545
TOTAL	**4081**
Products Lines	1181
NGL, LPG Lines	445
TOTAL	**1626**
Offshore Oil Lines	280
Offshore Gas Lines	252
TOTAL	**532**
GRAND TOTAL	**13,227**

Includes all free world (outside U.S.) plus Soviet Bloc and China



PIPELINE & GAS JOURNAL

Worldwide Planned Pipeline Projects At-A-Glance

(October 1982)

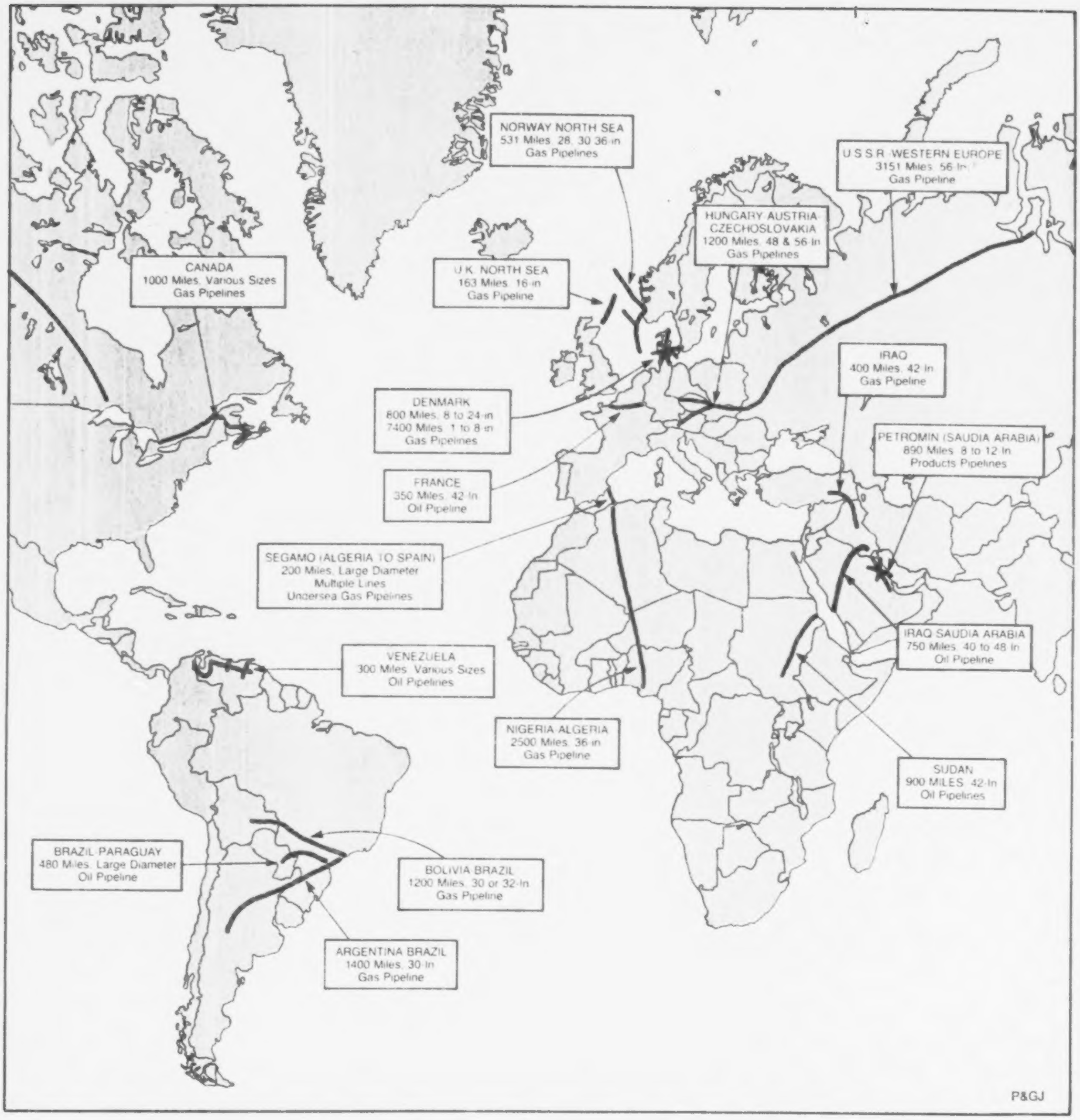
rate forecast, only one-third of the world's gas reserves will have been produced by 2020.

Key issues in expanding the vast pipeline networks and the use of gas as forecast are availability, cost, and security of supply. The latter will become critical as western nations, which have less than 25% of the remaining recoverable reserves, must import greater volumes of gas. Bulk of tomorrow's gas will be transported through pipelines. A relatively minor part will move by ocean (LNG) transport.

Debate continues in Europe about the role that natural gas will assume there in the next decade – will it or will it not provide 20% of the primary energy market. Most producers and distributors believe the answer lies in price – too high a price will exclude natural gas and find a return to oil and coal. The three principal future gas suppliers to Europe are Algeria, the Soviet Union, and Norway. Norway, new entrant into the gas supply realm, is building a 531-mile underwater system in the North Sea to move gas to Ekofisk and then to the Continent. Norway's Statoil says a higher price than paid now will be necessary to recover its investment in facilities to make gas available.

Russia's Sojuzgasexport views the 40 billion cu m of Siberian gas that it expects to supply to Western Europe annually as essentially a replacement for crude oil in the European market. The Siberian gas would also replace diminishing supplies now being provided from Dutch gas fields and, in France, local gas fields that are also diminishing. Algeria, with vast quantities of gas available, is expected to remain a major supplier to Europe but, because of its internal problems, will continue to press for higher prices.

U.S.S.R.'s 3151-mile, 56-in. gas pipeline from Urengoi fields in Western Siberia is being built despite pressure from the U.S. on its western European allies to slow or stop the flow of equipment and materials to the U.S.S.R. for the line's construction. The U.S. sanctions are seen as not being effective, and the Soviets have responded with renewed effort in the line's construction, noting that they will utilize Russian-made equipment wherever possible.


NORWAY NORTH SEA
531 Miles. 28, 30 36-in
Gas Pipelines
U.S.S.R.-WESTERN EUROPE
3151 Miles. 56-In.
Gas Pipeline
HUNGARY-AUSTRIA-CZECHOSLOVAKIA
1200 Miles. 48 & 56-In
Gas Pipelines
CANADA
1000 Miles. Various Sizes
Gas Pipelines
U.K. NORTH SEA
163 Miles. 16-in
Gas Pipeline
IRAQ
400 Miles. 42-In
Gas Pipeline
DENMARK
800 Miles. 8 to 24-in
7400 Miles. 1 to 8-in
Gas Pipelines
PETROMIN (SAUDIA ARABIA)
890 Miles. 8 to 12-In
Products Pipelines
FRANCE
350 Miles. 42-In
Oil Pipeline
SEGAMO (ALGERIA TO SPAIN)
200 Miles. Large Diameter
Multiple Lines
Undersea Gas Pipelines
IRAQ-SAUDIA ARABIA
750 Miles. 40 to 48-In
Oil Pipeline
VENEZUELA
300 Miles. Various Sizes
Oil Pipelines
NIGERIA-ALGERIA
2500 Miles. 36-in
Gas Pipeline
SUDAN
900 MILES. 42-In
Oil Pipelines
BRAZIL-PARAGUAY
480 Miles. Large Diameter
Oil Pipeline
BOLIVIA-BRAZIL
1200 Miles. 30 or 32-In
Gas Pipeline
ARGENTINA-BRAZIL
1400 Miles. 30-In
Gas Pipeline
P&GJ

The 56-in. line will terminate at Uzhgorod on the U.S.S.R. – Czechoslovakian border, where gas will be delivered into new pipelines planned for the eastern bloc countries – lines that will deliver the gas, ultimately, to France, Italy, West Germany, Belgium, Netherlands, and eventually to Spain.

The delivery system in Czechoslovakia, involving 900 km of 56-in. pipe, is to begin construction sometime in 1983. The line goes northeast through Czechoslovakia. In East Germany, some 400 km of 48-in. line will be built and in Hungary, 550 km of 48-in. will be built, assuming that Italy does agree to take the Soviet gas. The line going southeast through Hungary will deliver gas at the Austrian border – and the Austrian section of the line that will deliver gas to Italy will involve 220 km of 48-in.

No details have been announced in West Germany about delivery system plans there, but some 550 to 650 km of 40, 42, or 48-in. gas pipeline reportedly are being considered. Additional pipeline capacity will also be needed in northern Italy to deliver gas to a connection with the north end of the Trans-Mediterranean Pipeline running north-south in that country. Trans-Med and Italy's national gas agency, SNAM, have already changed the final section of the big line from 42-in. to 48-in. in anticipation of the new source of supply.

Overlooked in much of the hullabaloo about the new Soviet pipeline is that the Soviet Union has been supplying gas to Western Europe for a long time. Soviet gas supplies the East-West system in Europe, built in 1973, received in West Germany at Waidhaus. Soviet gas via the Orenburg line supplies the MEGAL (Middle European Gas Line) system, completed in 1980, which delivers gas to France and West Germany. Soviet gas has long been supplied through the Trans-Austrian Gas Line to Czechoslovakia, East Germany, Austria, and Italy.

European Developments

Much of the activity in Western Europe in 1982 centered around the North Sea, where numerous oil and gas lines were constructed in 1982, and where future activity is planned.

(Continued)

INTERNATIONAL PIPELINE CONSTRUCTION – BY COUNTRIES

(Underway, Planned, and Proposed – October 1982)

	Total Miles, Gas Pipelines			Total Miles, Crude Oil Pipelines			Total Miles, Products Pipelines			Total Miles, Slurry Pipelines			Total Miles, All Pipelines		
Country	**Planned**	**Underway**	**Total**	**Planned**	**Underway**	**Total**	**Planned**	**Underway**	**Total**	**Planned**	**Underway**	**Total**	**Planned**	**Underway**	**Total**
Abu Dhabi	275	185	460	64	0	64	—	—	—	—	—	—	339	185	524
Algeria	2187	815	3002	0	393	393	324	0	324	—	—	—	2511	1208	3719
Argentina	4136	0	4136	435	0	435	404	0	404	88	0	88	5063	0	5063
Australia	2541	84	2625	157	0	157	236	412	648	189	0	189	3123	496	3619
Austria	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Bangladesh	150	170	320	—	—	—	—	—	—	—	—	—	150	170	320
Belgium	245	60	305	—	—	—	—	—	—	—	—	—	245	60	305
Bolivia	5279	166	5445	—	—	—	536	0	536	—	—	—	5815	166	5981
Brazil	2228	264	2492	1169	51	1220	231	0	231	9	0	9	3637	315	3952
Bulgaria	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cameroon	125	0	125	2	0	2	—	—	—	—	—	—	127	0	127
Canada	10267	529	10796	1525	0	1525	417	0	417	500	0	500	12709	529	13238
Chad	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chile	650	22	672	10	16	26	0	25	25	46	0	46	706	63	769
China	1243	0	1243	2717	0	2717	373	0	373	—	—	—	4333	0	4333
Colombia	961	15	976	1159	50	1209	574	100	674	—	—	—	2694	165	2859
Congo	—	—	—	14	0	14	—	—	—	—	—	—	14	0	14
Costa Rica	—	—	—	—	—	—	35	0	35	—	—	—	35	0	35
Czechoslovakia	563	—	563	—	—	—	—	—	—	—	—	—	563	0	563
Denmark	7730	377	8107	—	—	—	—	—	—	—	—	—	7730	377	8107
Dubai	—	—	—	17	0	17	—	—	—	—	—	—	17	0	17
East Germany	250	0	250	—	—	—	—	—	—	—	—	—	250	0	250
Ecuador	494	0	494	231	0	231	—	—	—	—	—	—	725	0	725
Egypt	152	168	320	75	0	75	—	—	—	—	—	—	227	168	395
France	930	800	1730	350	0	350	169	0	169	—	—	—	1449	800	2249
Greece	70	0	70	50	0	50	—	—	—	—	—	—	120	0	120
Guatemala	—	—	—	237	0	237	—	—	—	—	—	—	237	0	237
Honduras	—	—	—	160	0	160	—	—	—	—	—	—	160	0	160
Hungary	344	—	344	188	0	188	112	0	112	—	—	—	644	0	644
India	786	0	786	18	0	18	336	0	336	620	0	620	1760	0	1760
Indonesia	660	37	697	105	0	105	—	—	—	—	—	—	765	37	802
Iran*	(1368)	0	(1368)	(1000)	—	(1000)	—	—	—	—	—	—	(2368)	0	(2368)
Iraq	400	250	650	2066	0	2066	1011	0	1011	—	—	—	3477	250	3727
Ireland	0	159	159	—	—	—	—	—	—	—	—	—	0	159	159
Italy	726	285	1011	—	—	—	—	—	—	—	—	—	726	285	1011
Ivory Coast	—	—	—	31	0	31	—	—	—	—	—	—	31	0	31
Japan	1080	0	1080	—	—	—	—	—	—	—	—	—	1080	0	1080
Kenya	—	—	—	—	—	—	248	0	248	—	—	—	248	0	248
Korea	—	—	—	450	0	450	—	—	—	—	—	—	450	0	450
Kuwait	89	0	89	400	35	435	0	23	23	—	—	—	489	58	547
Libya	0	58	58	723	481	1204	—	—	—	—	—	—	723	539	1262
Malaysia	220	0	220	—	—	—	—	—	—	—	—	—	220	0	220
Mexico	0	68	68	399	0	399	1160	151	1311	—	—	—	1559	219	1778
Netherlands	366	0	366	124	0	124	—	—	—	—	—	—	490	0	490
New Zealand	879	65	944	—	—	—	0	105	105	—	—	—	879	170	1049
Nigeria	2496	120	2616	346	0	346	—	—	—	—	—	—	2842	120	2962
Norway	0	531	531	—	—	—	—	—	—	—	—	—	0	531	531
North Yemen	—	—	—	—	—	—	228	0	228	—	—	—	228	0	228
Oman	132	203	335	472	271	743	—	—	—	—	—	—	604	474	1078
Pakistan	483	0	483	—	—	—	—	—	—	—	—	—	483	0	483
Panama	—	—	—	0	78	78	—	—	—	—	—	—	0	78	78
Peru	—	—	—	1017	0	1017	—	—	—	—	—	—	1017	0	1017
Poland	—	—	—	—	—	—	—	—	—	342	0	342	342	0	342
Portugal	—	—	—	—	—	—	69	0	69	—	—	—	69	0	69
Qatar	0	40	40	—	—	—	—	—	—	—	—	—	0	40	40
Saudi Arabia	1642	160	1802	448	155	603	1606	—	1606	—	—	—	3696	315	4011
South Africa	225	0	225	—	—	—	—	—	—	—	—	—	225	0	225
Spain	586	40	626	159	37	196	68	0	68	—	—	—	813	7	890
Sudan	—	—	—	894	0	894	—	—	—	—	—	—	894	0	894
Syria	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

(Continued)

INTERNATIONAL PIPELINE CONSTRUCTION – BY COUNTRIES .... *(Continued)*

(Underway, Planned, and Proposed – October 1982)

	Total Miles, Gas Pipelines			Total Miles, Crude Oil Pipelines			Total Miles, Products Pipelines			Total Miles, Slurry Pipelines			Total Miles, All Pipelines		
Country	**Planned**	**Underway**	**Total**	**Planned**	**Underway**	**Total**	**Planned**	**Underway**	**Total**	**Planned**	**Underway**	**Total**	**Planned**	**Underway**	**Total**
Sweden	1350	0	1350	—	—	—	—	—	—	—	—	—	1350	0	1350
Switzerland	7	0	7	—	—	—	—	—	—	—	—	—	7	0	7
Taiwan	—	—	—	160	0	160	170	220	390	—	—	—	330	220	550
Tanzania	—	—	—	—	—	—	678	0	678	—	—	—	678	0	678
Thailand	503	62	565	286	0	286	458	0	458	—	—	—	1117	62	1179
Tunisia	179	329	508	—	—	—	—	—	—	—	—	—	179	329	508
Turkey	0	50	50	280	0	280	250	0	250	—	—	—	530	50	580
Trinidad	45	0	45	—	—	—	—	—	—	—	—	—	45	0	45
United Kingdom	392	292	684	—	—	—	0	138	138	—	—	—	392	430	822
United Arab Emirates	46	0	46	—	—	—	23	0	23	—	—	—	69	0	69
USSR	9600	3622	13222	—	—	—	506	0	506	342	0	342	10448	3622	14070
Uruguay	189	0	189	—	—	—	—	—	—	—	—	—	189	0	189
Venezuela	171	143	314	263	122	385	16	0	16	—	—	—	450	265	715
W. Germany	266	22	288	81	0	81	201	0	201	—	—	—	548	22	570
Yugoslavia	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zaire	—	—	—	—	—	—	205	0	205	—	—	—	205	0	205
Zambia	—	—	—	—	—	—	380	0	380	—	—	—	380	0	380

Denmark's Dansk Olie & Naturgas A/S has a 134-mile, 30-in. gas line underway from offshore to Kergaard on the west coast of Jutland, and D.O.N.G.'s subsidiary, DORAS, is building a 137-mile, 20-in. oil from the same offshore area (Gorm and Tyra and Dan fields) to Kergaard. Onshore, D.O.N.G. has some 111 miles of lines underway, including dual 0.8-mile, 30-in. crossings across Lillebaelt and dual 18.8-mile, 30-in. crossings across Storebaelt. In the next five years, Danish regional gas utilities will construct some 8200 miles of gas laterals and gas distribution system, while D.O.N.G. completes the gas transmission system.

Norway's Statoil subsidiary Statpipe is moving ahead on plans for construction of its 531-mile, 28, 30, and 36-in. natural gas system in the North Sea to connect the Statfjord Field to a gas treatment plant at Karstø, with a link from the Karstø plant outlet to Sleipner platform, where a separate line from Heimdal Field will connect with the Karstø-Ekofisk line. All gas received at Ekofisk will move to Emden via an existing gas line.

Newest major gas line in the North Sea to be announced is Shell's proposed 163-mile, 16-in. line from its Fulmar Field in the U.K. sector to the St. Fergus, Scotland gas terminal. Probable construction date is 1984.

In Italy, work continues on the 48-in. Trans-Mediterranean Pipeline, the big gas line that crosses Italy from south to north and terminates near Minerbio. By late 1982, construction crews expect to reach Civita Castellana, with the remaining 200 miles of 48-in. to be installed in 1983.

Sweden's state power board, Vattenfall, is investigating the possibility of building a gas trunk pipeline to link northern Norwegian discoveries through Sweden to West Central Europe. Project would have two phases – first, northern Norwegian gas to Sweden and then via Sweden to Finland and Norway; second, northern Norwegian gas via Sweden to western Central Europe. Project time frame is as early as 1990. Current estimates are that some 1100 miles of large diameter line would be needed. Norway is also reported to be studying an alternative route to bring the northern Norwegian gas directly south via Norwegian territory.

The regional gas utility in Sweden, Sydgas, is moving ahead with plans to build in 1984 a 185-mile gas trunk line from Malmo to Halmsted; gas would be supplied from Denmark via a 65-mile, 24-in. line from north of Copenhagen to Malmo.

Other major European projects underway and nearing completion include Ireland's 159-mile, 18-in. gas line from Dublin to Cork – to be the backbone of Ireland's major gas distribution grid.

British Gas Corp. has completed the final phases in Scotland of its 283-mile, 42-in. Fourth Feeder Line, and work is progressing on the initial 50 miles of the 138-mile, 20-in. natural gas liquids line in Scotland between St. Fergus and Mossmoran. In France, work is being completed on 225 miles of gas lines, while in West Germany, work is progressing on an 81-mile, 22-in. oil line between Hamburg and Wilhelmshaven. Spain's Enagas is reported to be planning some 1500 additional miles of gas lines to be built by the end of 1985.

Middle East and Africa

In the Middle East and Africa, pipeline activity is quite intensive in terms of both lines under construction and lines planned, with 3339 miles underway and 21,084 miles planned for 1983 and beyond. Included are 9927 miles of gas pipelines, 6181 miles of oil pipelines, and 4976 miles of products and natural gas liquids lines.

For 1983, nearly 2500 miles of pipelines are expected to be completed in Saudi Arabia, including 400 miles of crude oil lines and 1500 miles of products and NGL gathering lines. In Oman, some 474 miles of oil and gas lines are underway; in Qatar, 40 miles of gas lines; in Kuwait 58 miles of gathering lines. Work in Libya continues on some 500 miles of pipeline, while in Algeria, current construction includes a 265-mile, 48-in. oil line and a 393-mile, 30-in. oil line; two major 320-mile projects are expected to begin in early 1983 when contract agreements are completed. In Tunisia, work is planned on 250 miles of various gas laterals for STEG.

Other major projects in Africa of super-project size include the 2500-mile large diameter (36 or 42-in.) gas pipeline from Nigeria's Bonny Field to the Mediterranean coast (for ultimate delivery to western Europe); 120 miles of 24-in. gas pipeline elsewhere in Nigeria; 900 miles of large diameter oil line in Sudan planned by Chevron and the Sudan government to transport oil from the Unity field to tidewater – plans for a refinery have been deferred; 650 miles of various size products pipelines proposed in Tanzania, to be built in 1984 and 1985, and 250 miles of products lines planned for Kenya.

S.E. Asia, Pacific, Australia, New Zealand

In Australia, the 411-mile, 14-in. gas liquids pipeline from Moomba in the Cooper Basin south to Stony Point on the

Italy's 48-in. Trans-Mediterranean Pipeline crosses rugged mountains and farmland valleys along its route from south to north; this view of pipe gang moving up-slope is from in the south of Italy.

Spencer Gulf, being built for Santos Ltd., is nearing completion. Some 60 miles of oil and gas gathering lines in the Cooper Basin are underway. Construction contracts are expected to be finalized by the end of 1982 for the 921-mile, 20 and 26-in. Perth to Dampier gas pipeline to be built for the State Energy Commission of Western Australia. Work on the 80-mile, 40-in. offshore gas pipeline in the Northwest Shelf area is underway and is scheduled to be completed in early 1983.

During the next three to five years, Australia and New Zealand will experience substantial pipeline activity – 4000 miles of gas, oil, products, and slurry pipelines are planned and most are expected to be built in that timeframe. New Zealand's current major project is a 105-mile, 10-in. products line between Marsden Point and Wiri.

Ready for the pull. Crew from Nacap prepares to pull section of pipe for river crossing along route of the St. Fergus-Mossmoran gas liquids pipeline in Scotland.

Some 489 miles of pipeline projects are underway in Southeast Asia, Taiwan, Korea, and Japan, and 6668 miles of new lines are planned in this vast area. Major projects underway include 170 miles of gas pipelines in Bangladesh; 38 miles of gas line in Indonesia and 220 miles of gas line in Pakistan. The Thai government's approval of gas exports (as LNG) is expected to spur plans for both offshore and onshore gas pipeline work. Two lines proposed involve underwater lines from existing platforms to shore in southern Thailand – one from the Union Platform (131 miles) and one from the Texas Pacific platform (130 miles).

Taiwan plans 160 miles of oil lines and 170 miles of products line and is presently building 218 miles of products lines. Korea plans a major project involving 450 miles of oil pipelines. In Japan, major pipeline plans include 1060 miles of gas pipelines, most of them related to bringing gas from the Sakhalin Peninsula in the U.S.S.R. to Hokkaido and then south to Honshu.

South and Central America, Mexico

Mexico's pipeline activity has been slowed considerably by economic difficulties and declining markets for its export oil. Regardless, during 1982 Pemex reportedly has constructed some 3100 miles of new pipelines and for 1983 has plans for 1559 miles of oil and products pipelines.

In Panama, work is being completed on the 78-mile oil pipeline across the Isthmus, which will permit tankers from Alaska to unload on the West Coast and transfer loads to tankers on the East Coast, avoiding a long, costly trip through the crowded Panana Canal.

Throughout South America, projects abound, most of them related to movement of natural gas and oil from remote production areas to population centers. Beginning dates for many of the projects have slipped because of economic conditions or political conditions, but most remain feasible and desirable. Argentina, for example, has plans for over 4000 miles of new gas pipelines. Bolivia is planning over 5000 miles of new gas lines, while Brazil is planning 2500 miles of gas lines – and has a new proposal, a 480-mile line to deliver oil to Paraguay.

Colombia is planning over 950 miles of gas lines and 1150 miles of oil pipelines; Chile is working on design of a 400-mile gas line, and Peru is planning a 600-mile oil pipeline.

Canada

Canadian pipeline activity has been excellent in 1982 with a number of major projects completed and underway. Outlook for 1983 was dealt a blow with the two-year delay on construction of the Alaskan Highway Gas Pipeline Project, but the huge 48 and 56-in. line is expected to be built later. Meanwhile, Canada is looking at plans for the Trans-Quebec and Maritimes project (over 1000 miles of line), and numerous other smaller projects to fill in the gaps. The Polar Gas Project remains viable and prospects for new gas lines, oil lines, and even a 500-mile slurry line are considered good.

Soviet Union

U.S.S.R.'s big 56-in. gas line from western Siberia to the U.S.S.R.-Czechoslovakian border has mustered great attention throughout the world – overshadowing other pipeline activity and plans behind the Iron Curtain. The Soviet five-year plan for 1981-1985 calls for 20,000 miles of gas pipelines (10,375 miles to be 56-in. diameter) plus over 7000 miles of oil lines and 4000 miles of products lines. Part of these lines have been built, and P&GJ's survey indicates that the remainder probably will be built.

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